Fig. 1.

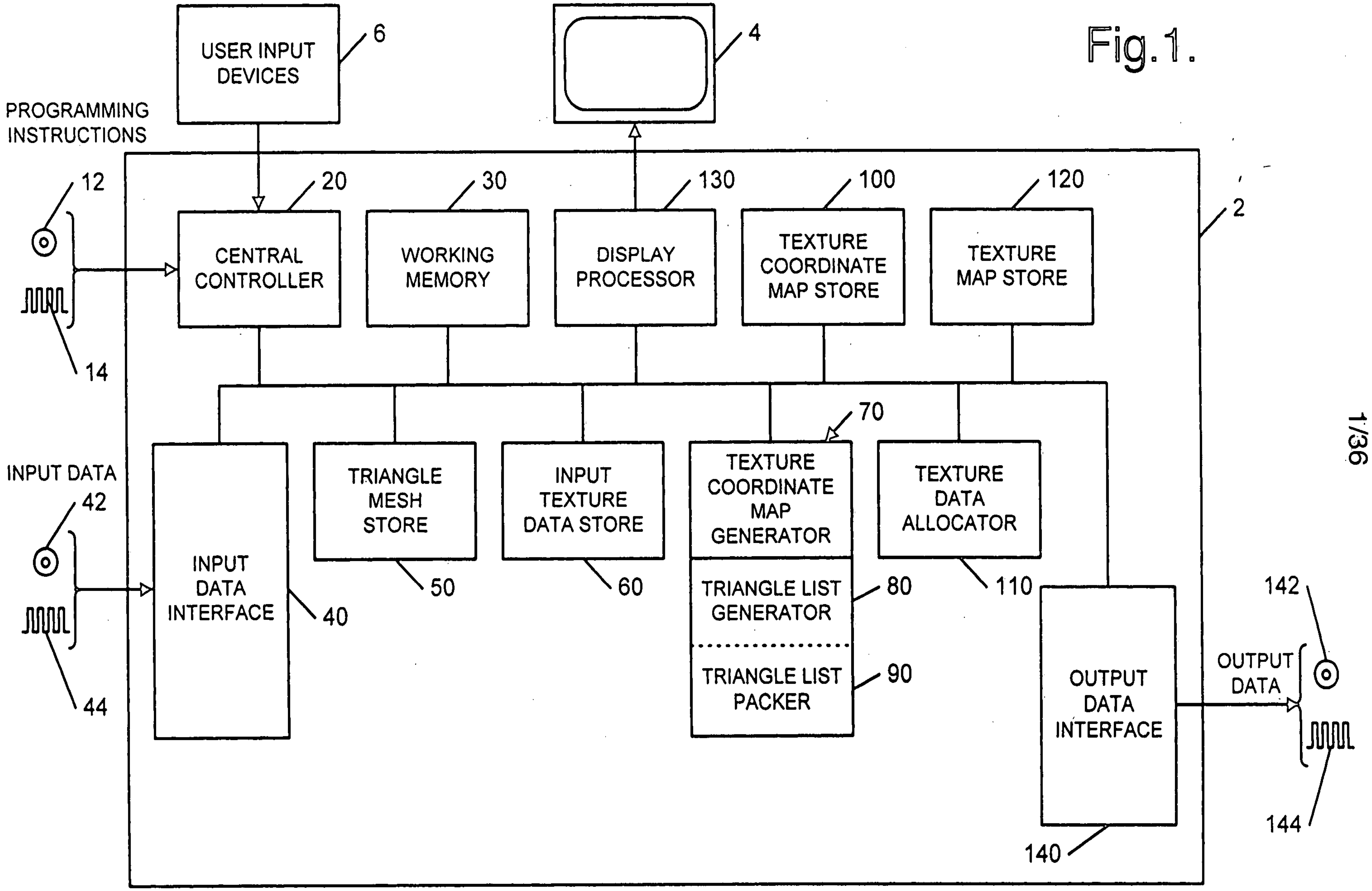
USER INPUT DEVICES
6
4
PROGRAMMING INSTRUCTIONS
12
14
20
CENTRAL CONTROLLER
30
WORKING MEMORY
130
DISPLAY PROCESSOR
100
TEXTURE COORDINATE MAP STORE
120
TEXTURE MAP STORE
2
70
INPUT DATA
42
44
INPUT DATA INTERFACE
40
TRIANGLE MESH STORE
50
INPUT TEXTURE DATA STORE
60
TEXTURE COORDINATE MAP GENERATOR
TRIANGLE LIST GENERATOR
80
TRIANGLE LIST PACKER
90
TEXTURE DATA ALLOCATOR
110
OUTPUT DATA INTERFACE
140
OUTPUT DATA
142
144

Fig.2.

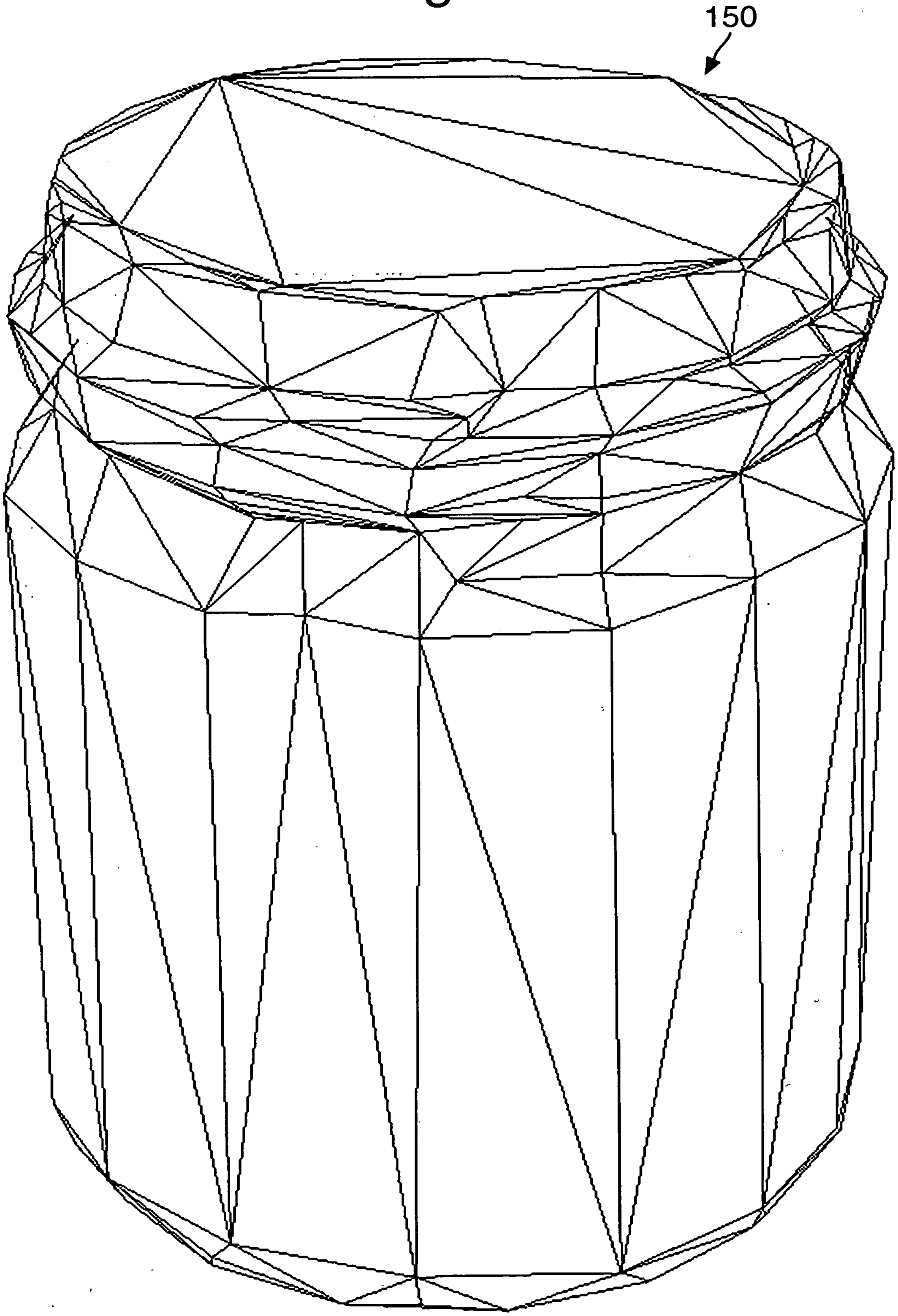

Fig.3a.

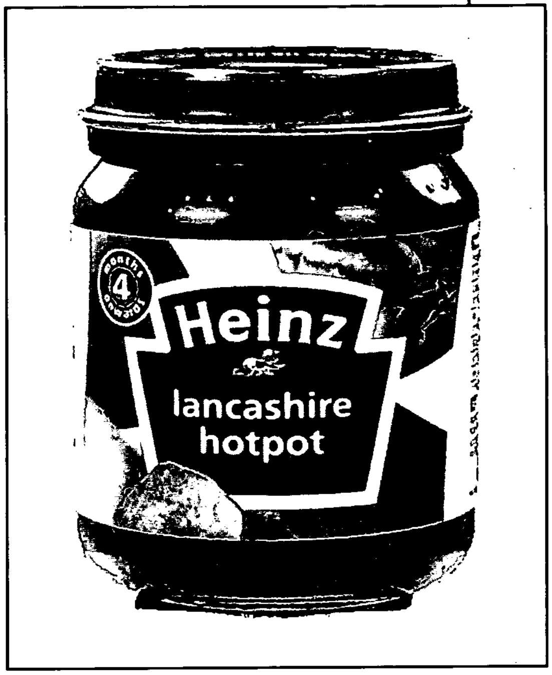

Fig.3b.

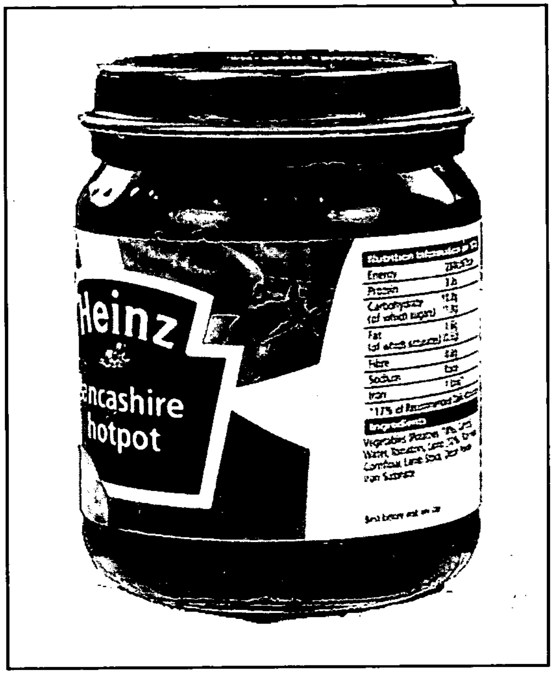

Fig.3c.

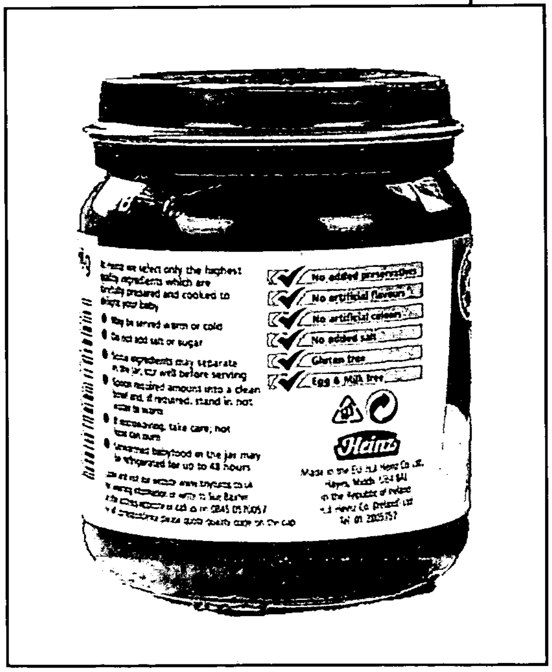

Fig.3d.

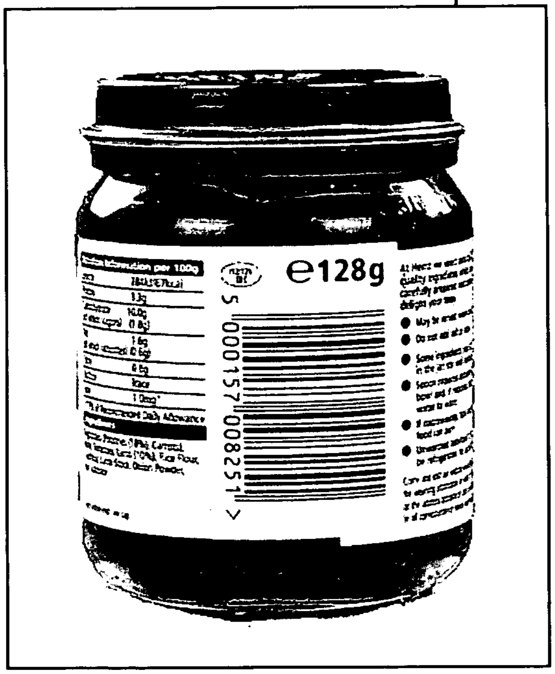

Fig.4.

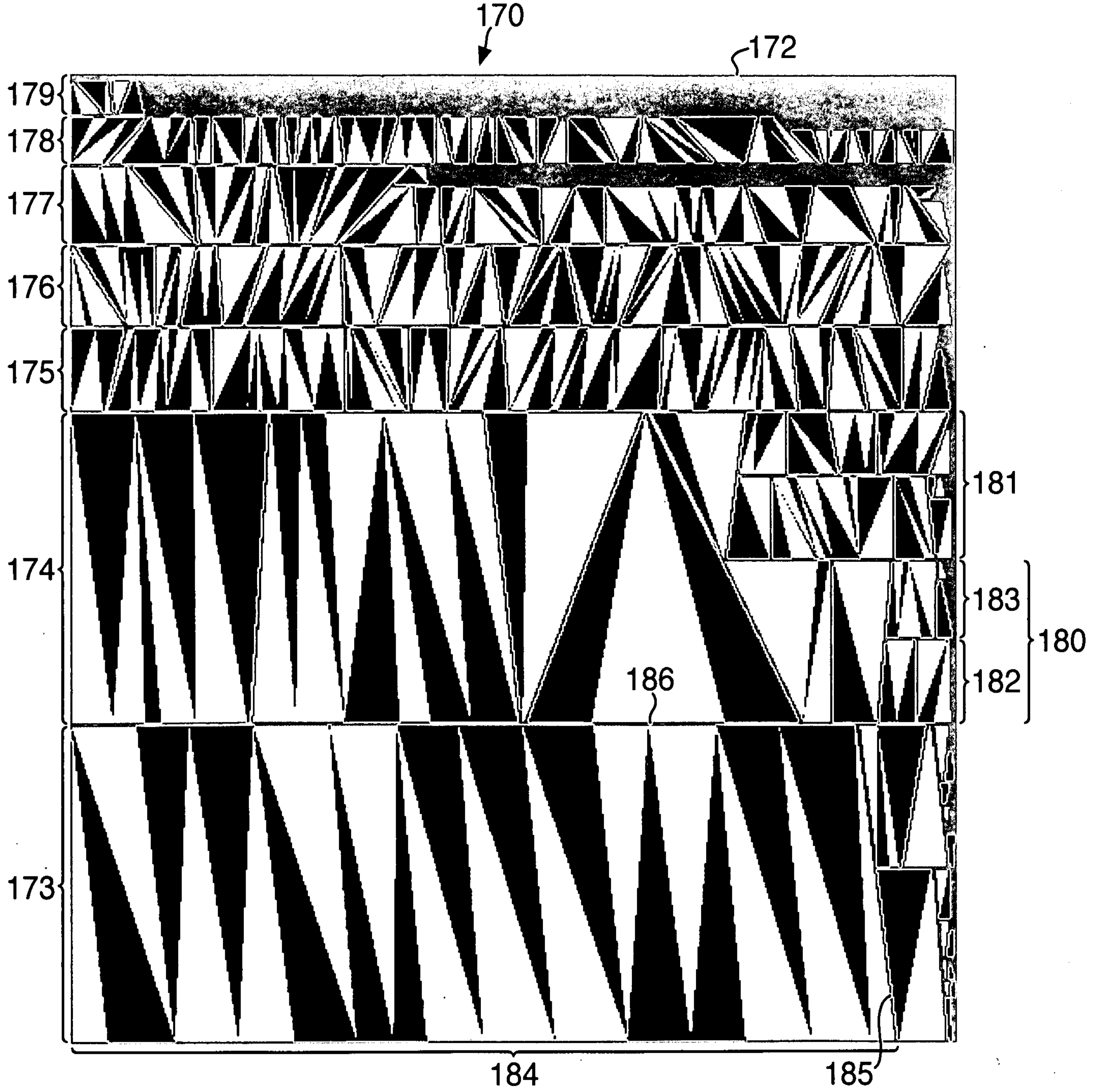

Fig.5.

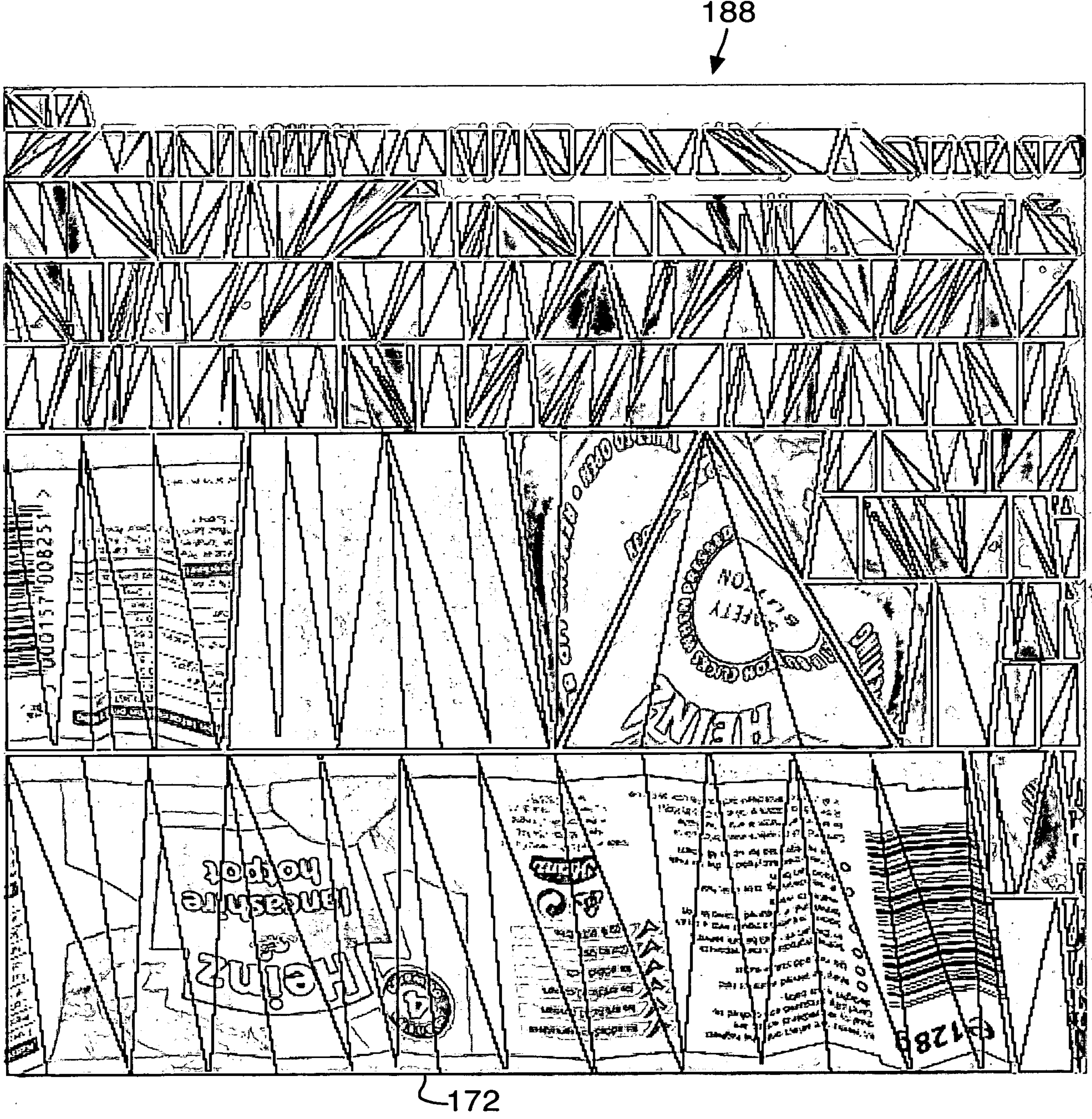

Fig.6.

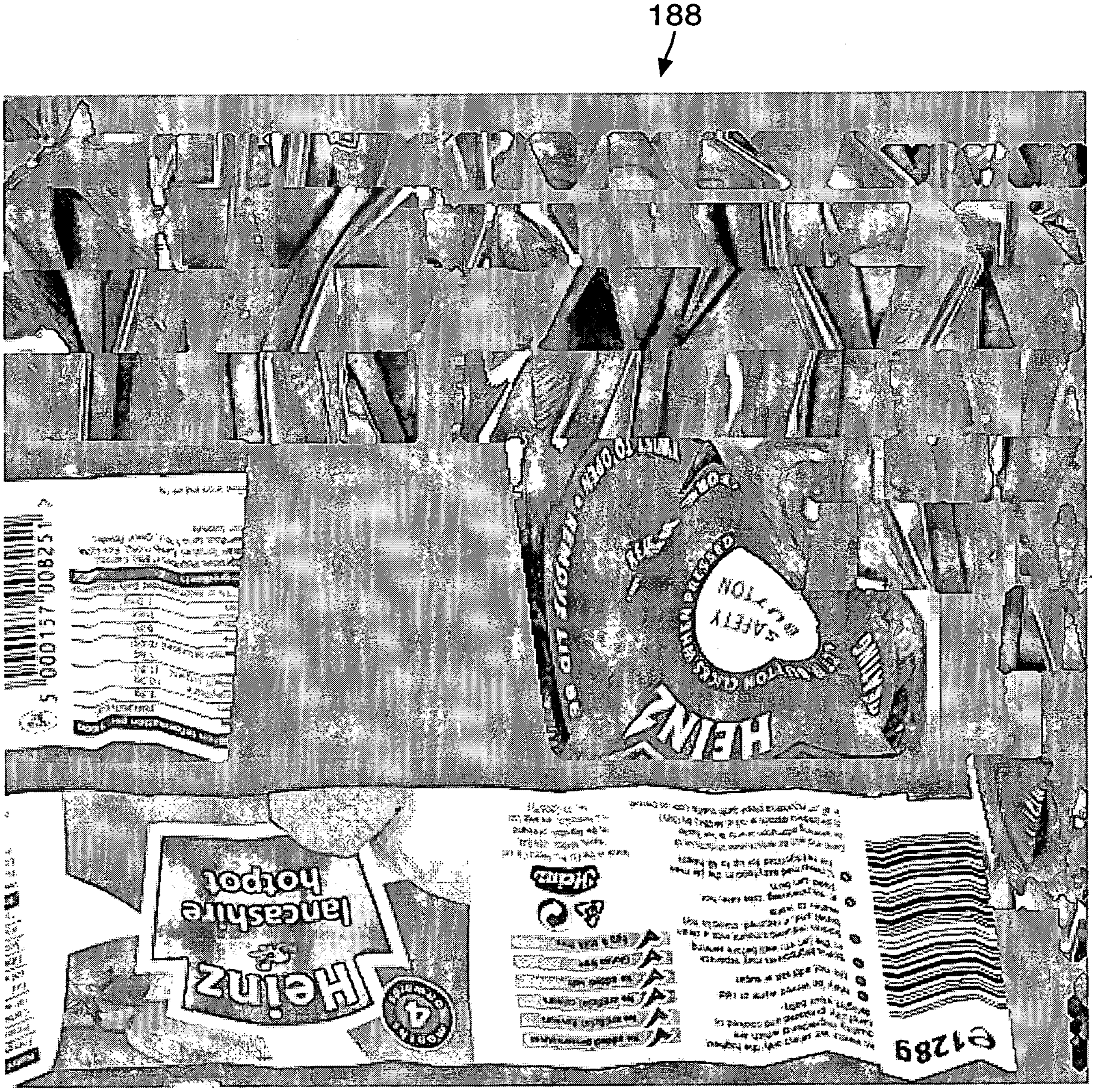

Fig.7.

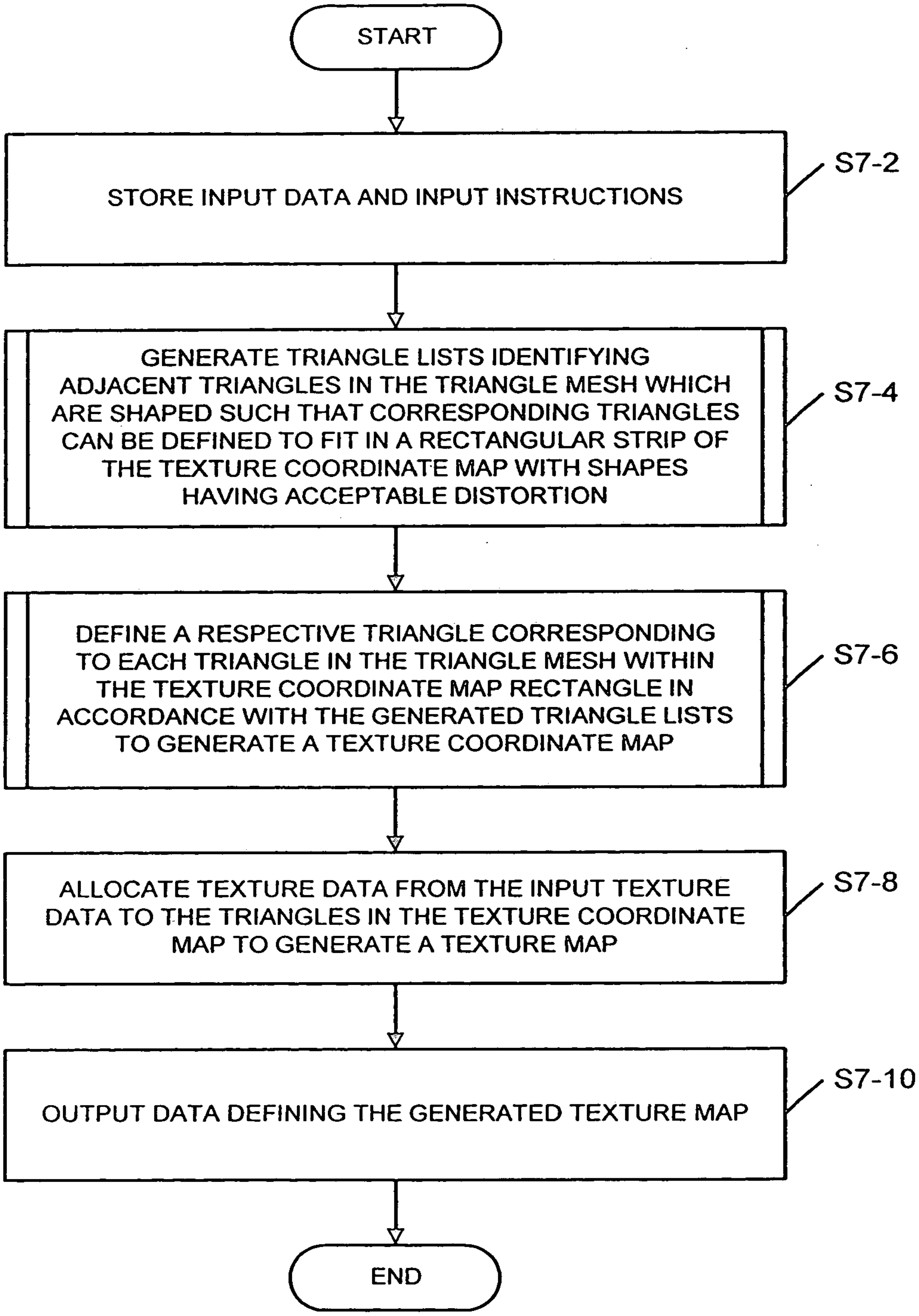
START
STORE INPUT DATA AND INPUT INSTRUCTIONS
S7-2
GENERATE TRIANGLE LISTS IDENTIFYING ADJACENT TRIANGLES IN THE TRIANGLE MESH WHICH ARE SHAPED SUCH THAT CORRESPONDING TRIANGLES CAN BE DEFINED TO FIT IN A RECTANGULAR STRIP OF THE TEXTURE COORDINATE MAP WITH SHAPES HAVING ACCEPTABLE DISTORTION
S7-4
DEFINE A RESPECTIVE TRIANGLE CORRESPONDING TO EACH TRIANGLE IN THE TRIANGLE MESH WITHIN THE TEXTURE COORDINATE MAP RECTANGLE IN ACCORDANCE WITH THE GENERATED TRIANGLE LISTS TO GENERATE A TEXTURE COORDINATE MAP
S7-6
ALLOCATE TEXTURE DATA FROM THE INPUT TEXTURE DATA TO THE TRIANGLES IN THE TEXTURE COORDINATE MAP TO GENERATE A TEXTURE MAP
S7-8
OUTPUT DATA DEFINING THE GENERATED TEXTURE MAP
S7-10
END

Fig.8.

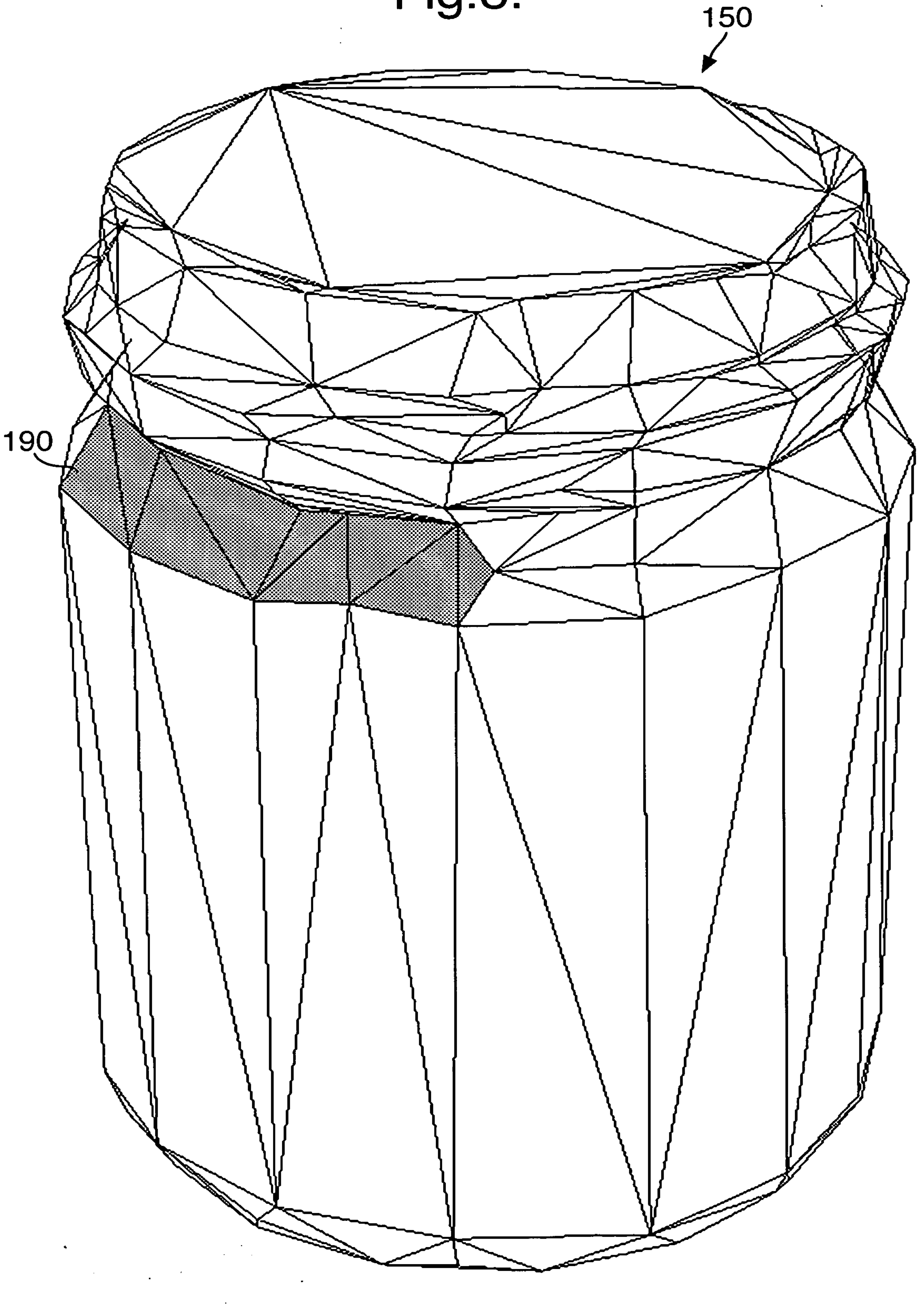

Fig.9a.

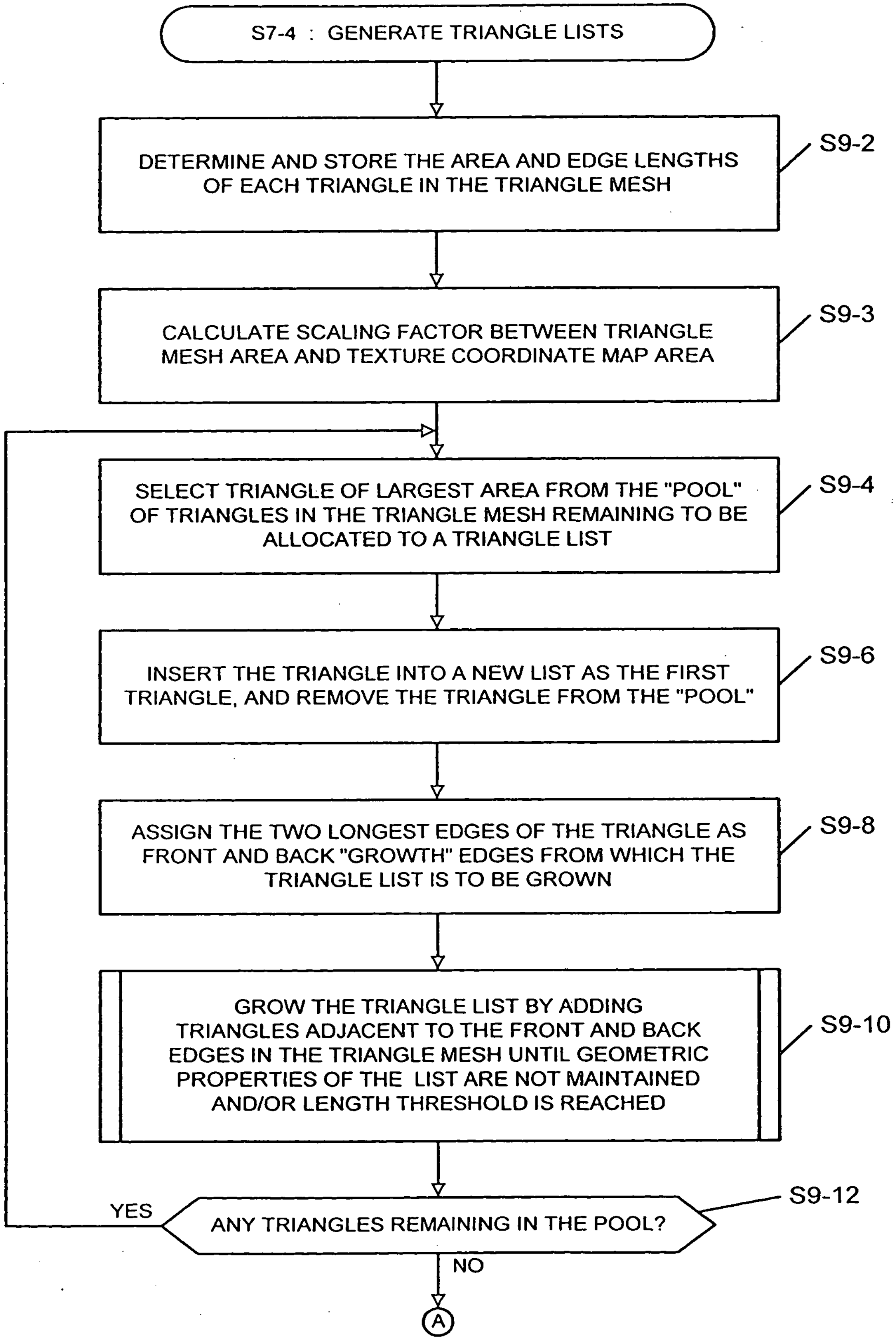
S7-4 : GENERATE TRIANGLE LISTS
DETERMINE AND STORE THE AREA AND EDGE LENGTHS OF EACH TRIANGLE IN THE TRIANGLE MESH
S9-2
CALCULATE SCALING FACTOR BETWEEN TRIANGLE MESH AREA AND TEXTURE COORDINATE MAP AREA
S9-3
SELECT TRIANGLE OF LARGEST AREA FROM THE "POOL" OF TRIANGLES IN THE TRIANGLE MESH REMAINING TO BE ALLOCATED TO A TRIANGLE LIST
S9-4
INSERT THE TRIANGLE INTO A NEW LIST AS THE FIRST TRIANGLE, AND REMOVE THE TRIANGLE FROM THE "POOL"
S9-6
ASSIGN THE TWO LONGEST EDGES OF THE TRIANGLE AS FRONT AND BACK "GROWTH" EDGES FROM WHICH THE TRIANGLE LIST IS TO BE GROWN
S9-8
GROW THE TRIANGLE LIST BY ADDING TRIANGLES ADJACENT TO THE FRONT AND BACK EDGES IN THE TRIANGLE MESH UNTIL GEOMETRIC PROPERTIES OF THE LIST ARE NOT MAINTAINED AND/OR LENGTH THRESHOLD IS REACHED
S9-10
YES
ANY TRIANGLES REMAINING IN THE POOL?
S9-12
NO
A

Fig.9b.

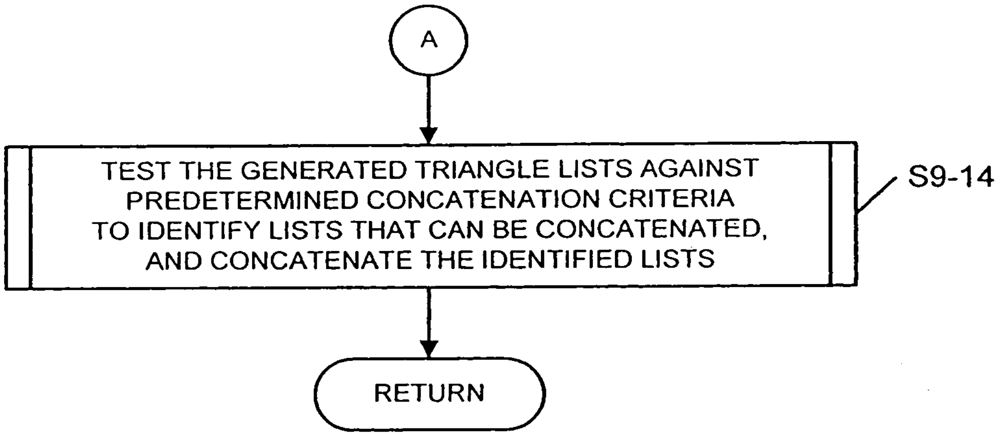
A
TEST THE GENERATED TRIANGLE LISTS AGAINST PREDETERMINED CONCATENATION CRITERIA TO IDENTIFY LISTS THAT CAN BE CONCATENATED, AND CONCATENATE THE IDENTIFIED LISTS
S9-14
RETURN

Fig.10a.

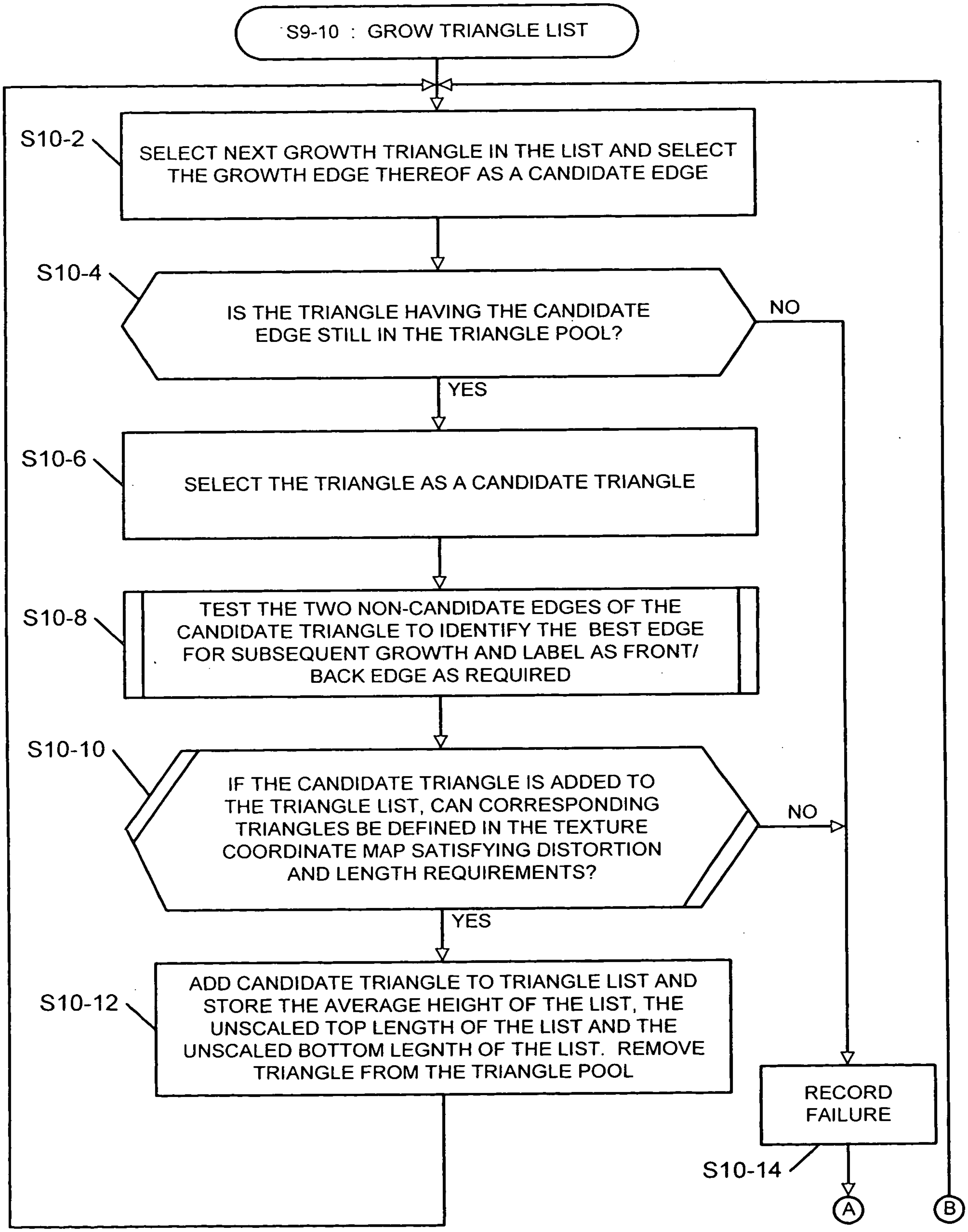
S9-10 : GROW TRIANGLE LIST
S10-2
SELECT NEXT GROWTH TRIANGLE IN THE LIST AND SELECT THE GROWTH EDGE THEREOF AS A CANDIDATE EDGE
S10-4
IS THE TRIANGLE HAVING THE CANDIDATE EDGE STILL IN THE TRIANGLE POOL?
NO
YES
S10-6
SELECT THE TRIANGLE AS A CANDIDATE TRIANGLE
S10-8
TEST THE TWO NON-CANDIDATE EDGES OF THE CANDIDATE TRIANGLE TO IDENTIFY THE BEST EDGE FOR SUBSEQUENT GROWTH AND LABEL AS FRONT/ BACK EDGE AS REQUIRED
S10-10
IF THE CANDIDATE TRIANGLE IS ADDED TO THE TRIANGLE LIST, CAN CORRESPONDING TRIANGLES BE DEFINED IN THE TEXTURE COORDINATE MAP SATISFYING DISTORTION AND LENGTH REQUIREMENTS?
NO
YES
S10-12
ADD CANDIDATE TRIANGLE TO TRIANGLE LIST AND STORE THE AVERAGE HEIGHT OF THE LIST, THE UNSCALED TOP LENGTH OF THE LIST AND THE UNSCALED BOTTOM LEGNTH OF THE LIST. REMOVE TRIANGLE FROM THE TRIANGLE POOL
RECORD FAILURE
S10-14
A
B

Fig.10b.

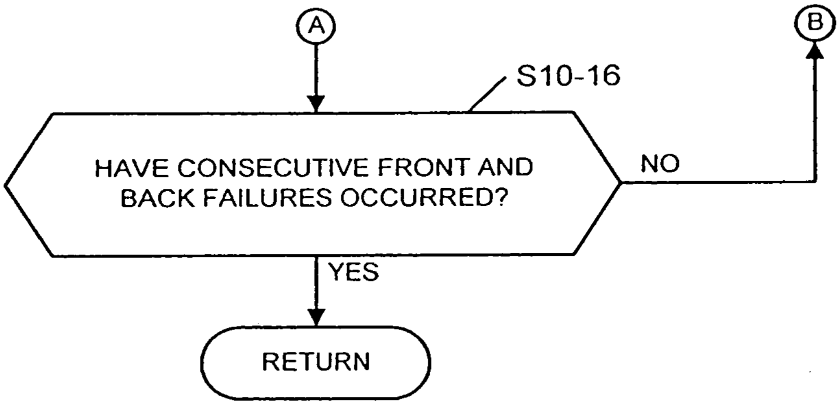
A
B
S10-16
HAVE CONSECUTIVE FRONT AND BACK FAILURES OCCURRED?
NO
YES
RETURN

Fig.11a.

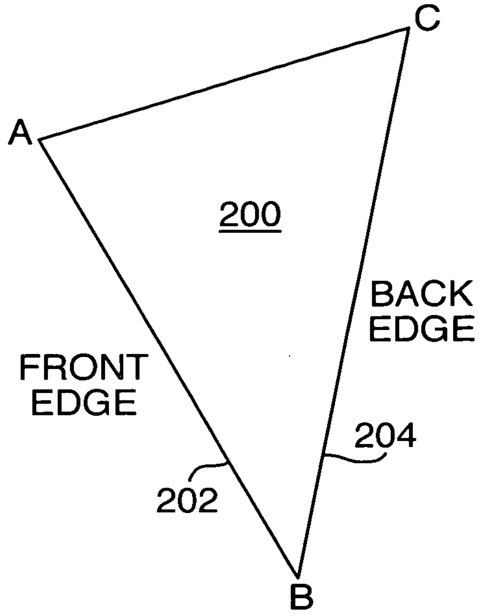

Fig.11b.

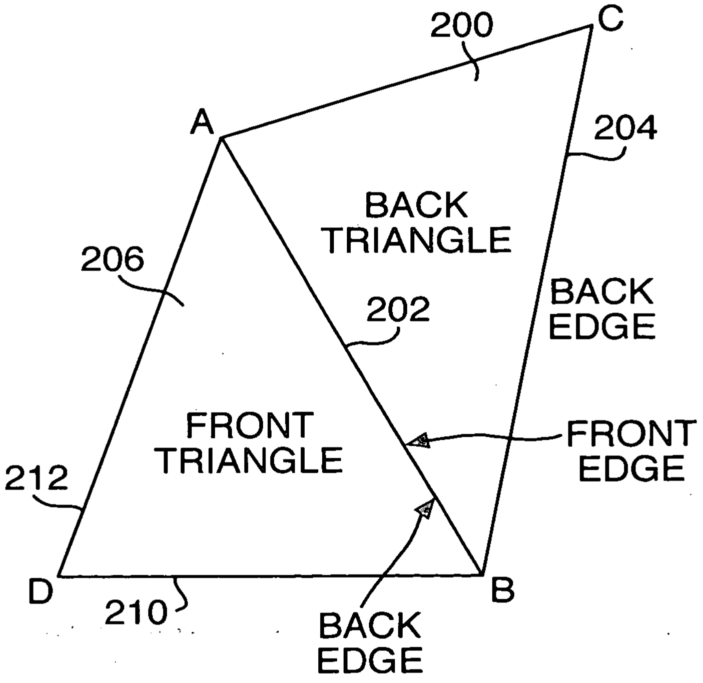

Fig.11c.

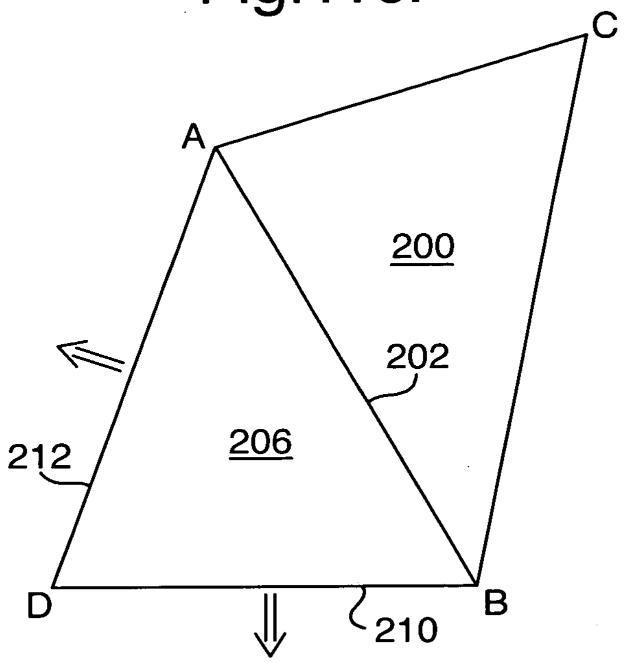

Fig.11d.

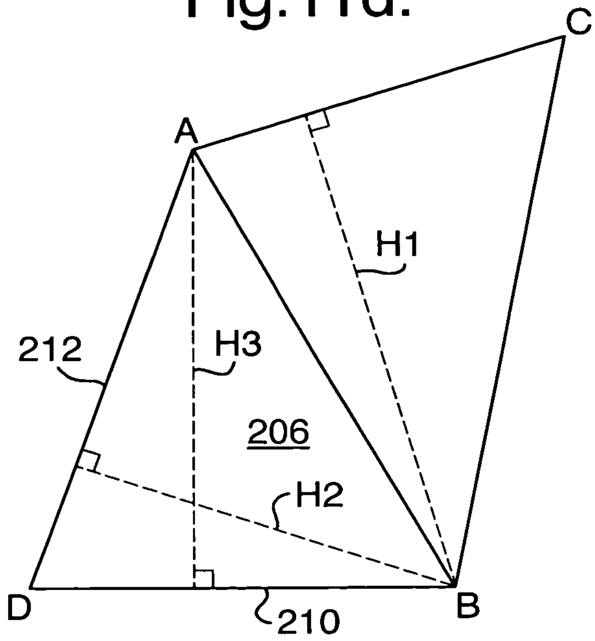

Fig.12a.

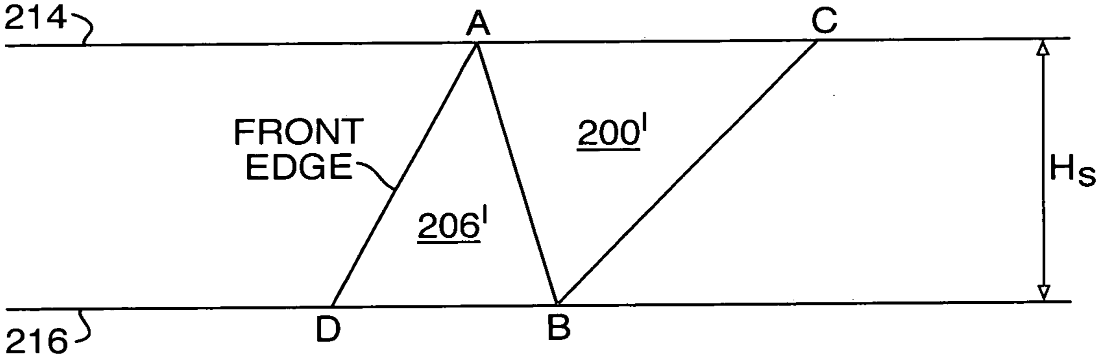

Fig.12b.

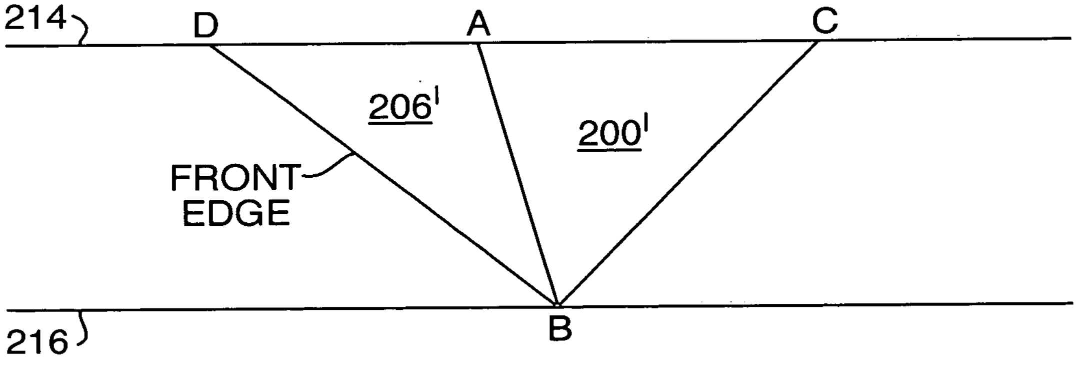

Fig.13a.

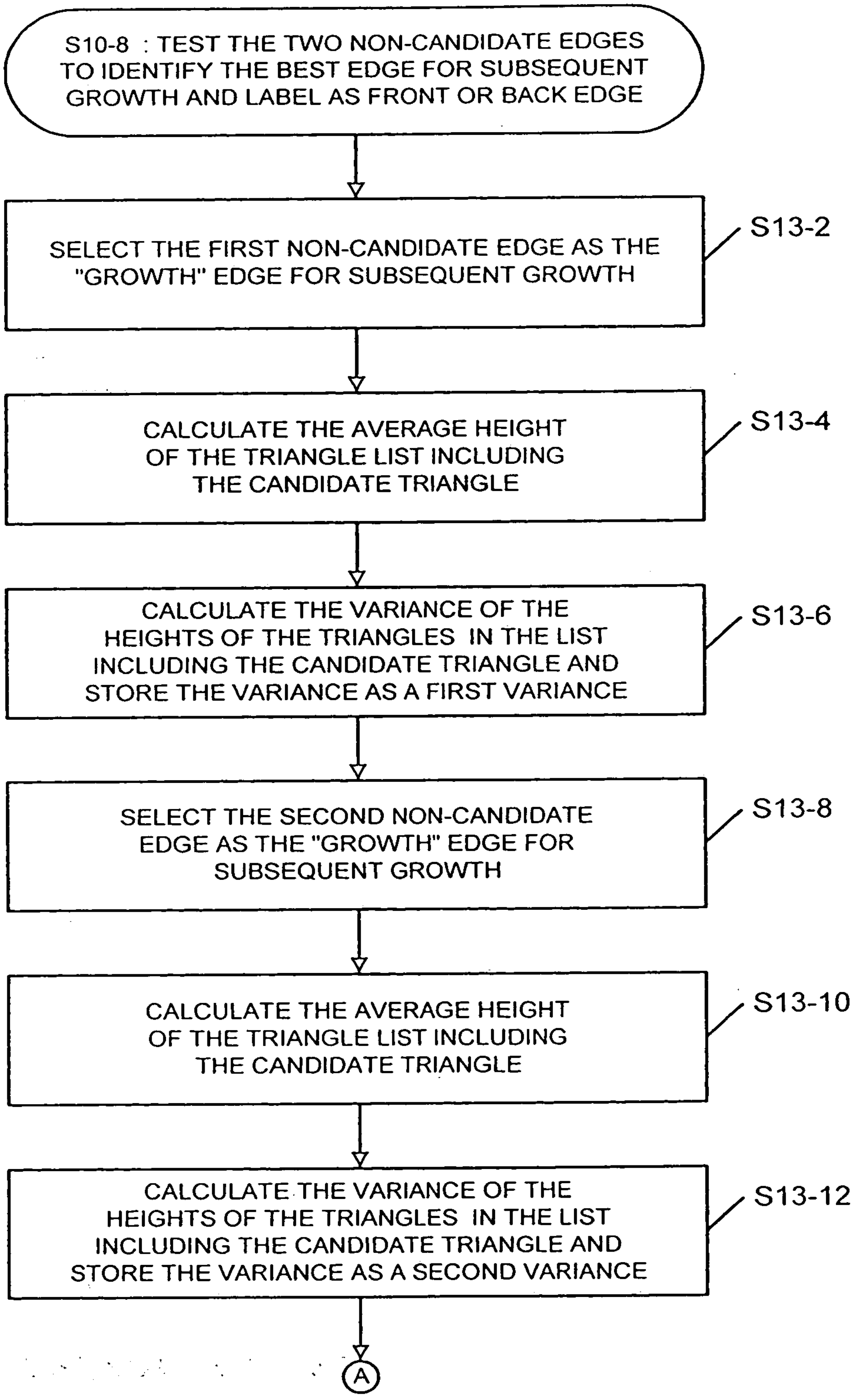
S10-8 : TEST THE TWO NON-CANDIDATE EDGES TO IDENTIFY THE BEST EDGE FOR SUBSEQUENT GROWTH AND LABEL AS FRONT OR BACK EDGE
SELECT THE FIRST NON-CANDIDATE EDGE AS THE "GROWTH" EDGE FOR SUBSEQUENT GROWTH
S13-2
CALCULATE THE AVERAGE HEIGHT OF THE TRIANGLE LIST INCLUDING THE CANDIDATE TRIANGLE
S13-4
CALCULATE THE VARIANCE OF THE HEIGHTS OF THE TRIANGLES IN THE LIST INCLUDING THE CANDIDATE TRIANGLE AND STORE THE VARIANCE AS A FIRST VARIANCE
S13-6
SELECT THE SECOND NON-CANDIDATE EDGE AS THE "GROWTH" EDGE FOR SUBSEQUENT GROWTH
S13-8
CALCULATE THE AVERAGE HEIGHT OF THE TRIANGLE LIST INCLUDING THE CANDIDATE TRIANGLE
S13-10
CALCULATE THE VARIANCE OF THE HEIGHTS OF THE TRIANGLES IN THE LIST INCLUDING THE CANDIDATE TRIANGLE AND STORE THE VARIANCE AS A SECOND VARIANCE
S13-12
A

Fig.13b.

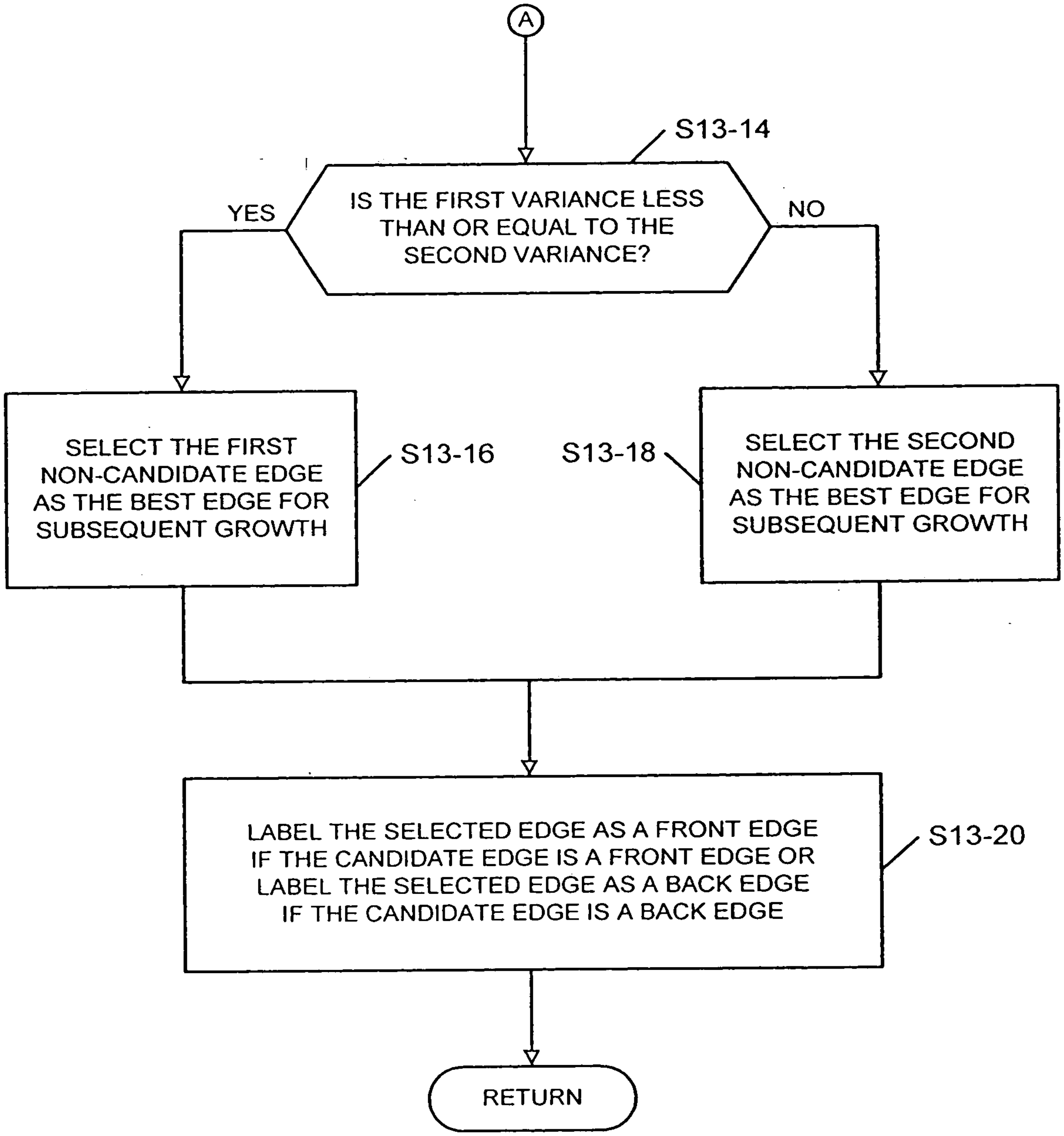
A
S13-14
IS THE FIRST VARIANCE LESS THAN OR EQUAL TO THE SECOND VARIANCE?
YES
NO
SELECT THE FIRST NON-CANDIDATE EDGE AS THE BEST EDGE FOR SUBSEQUENT GROWTH
S13-16
S13-18
SELECT THE SECOND NON-CANDIDATE EDGE AS THE BEST EDGE FOR SUBSEQUENT GROWTH
LABEL THE SELECTED EDGE AS A FRONT EDGE IF THE CANDIDATE EDGE IS A FRONT EDGE OR LABEL THE SELECTED EDGE AS A BACK EDGE IF THE CANDIDATE EDGE IS A BACK EDGE
S13-20
RETURN

Fig.14a.

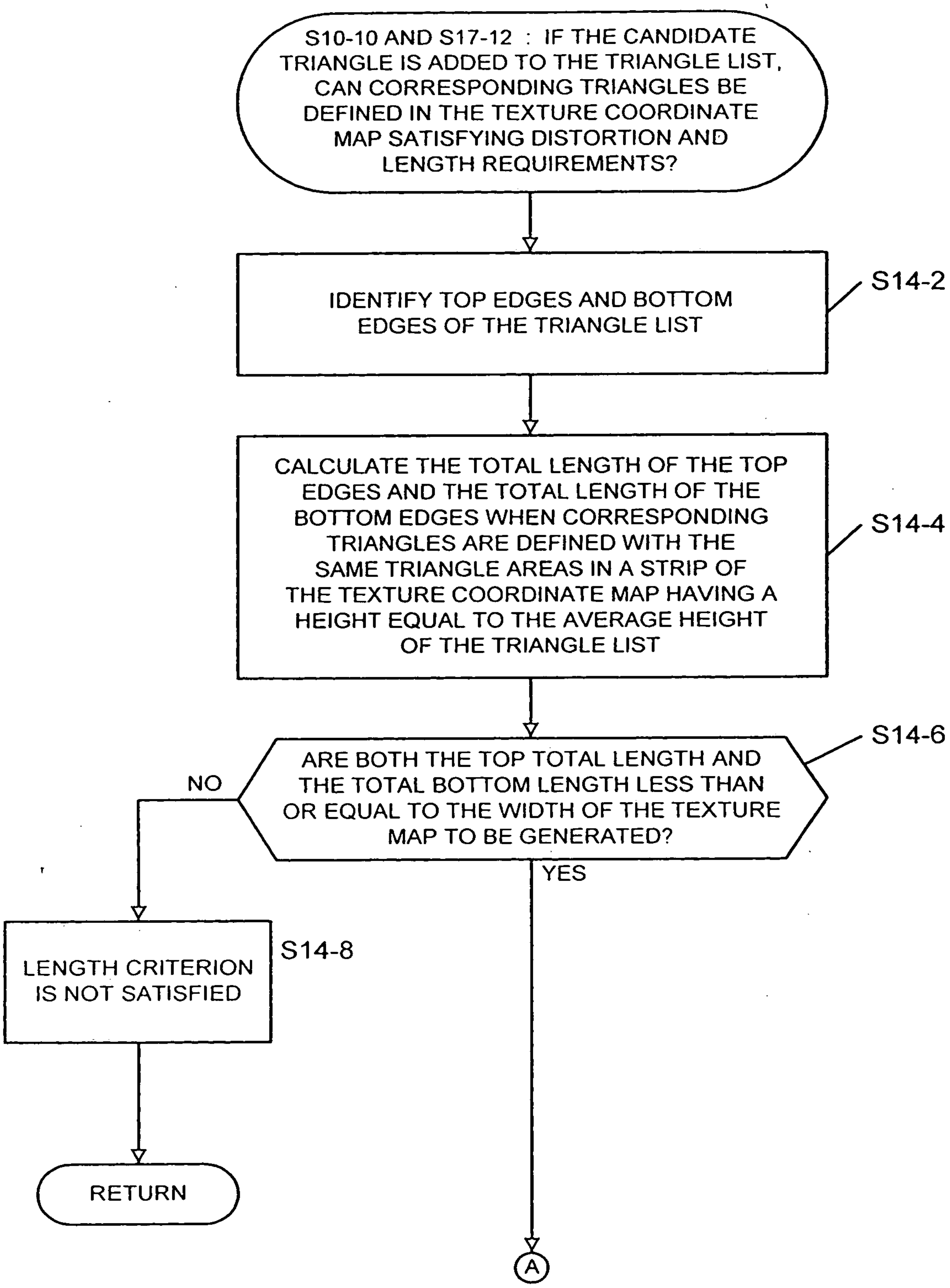
S10-10 AND S17-12 : IF THE CANDIDATE TRIANGLE IS ADDED TO THE TRIANGLE LIST, CAN CORRESPONDING TRIANGLES BE DEFINED IN THE TEXTURE COORDINATE MAP SATISFYING DISTORTION AND LENGTH REQUIREMENTS?
IDENTIFY TOP EDGES AND BOTTOM EDGES OF THE TRIANGLE LIST
S14-2
CALCULATE THE TOTAL LENGTH OF THE TOP EDGES AND THE TOTAL LENGTH OF THE BOTTOM EDGES WHEN CORRESPONDING TRIANGLES ARE DEFINED WITH THE SAME TRIANGLE AREAS IN A STRIP OF THE TEXTURE COORDINATE MAP HAVING A HEIGHT EQUAL TO THE AVERAGE HEIGHT OF THE TRIANGLE LIST
S14-4
ARE BOTH THE TOP TOTAL LENGTH AND THE TOTAL BOTTOM LENGTH LESS THAN OR EQUAL TO THE WIDTH OF THE TEXTURE MAP TO BE GENERATED?
S14-6
NO
YES
LENGTH CRITERION IS NOT SATISFIED
S14-8
RETURN
A

Fig.14b.

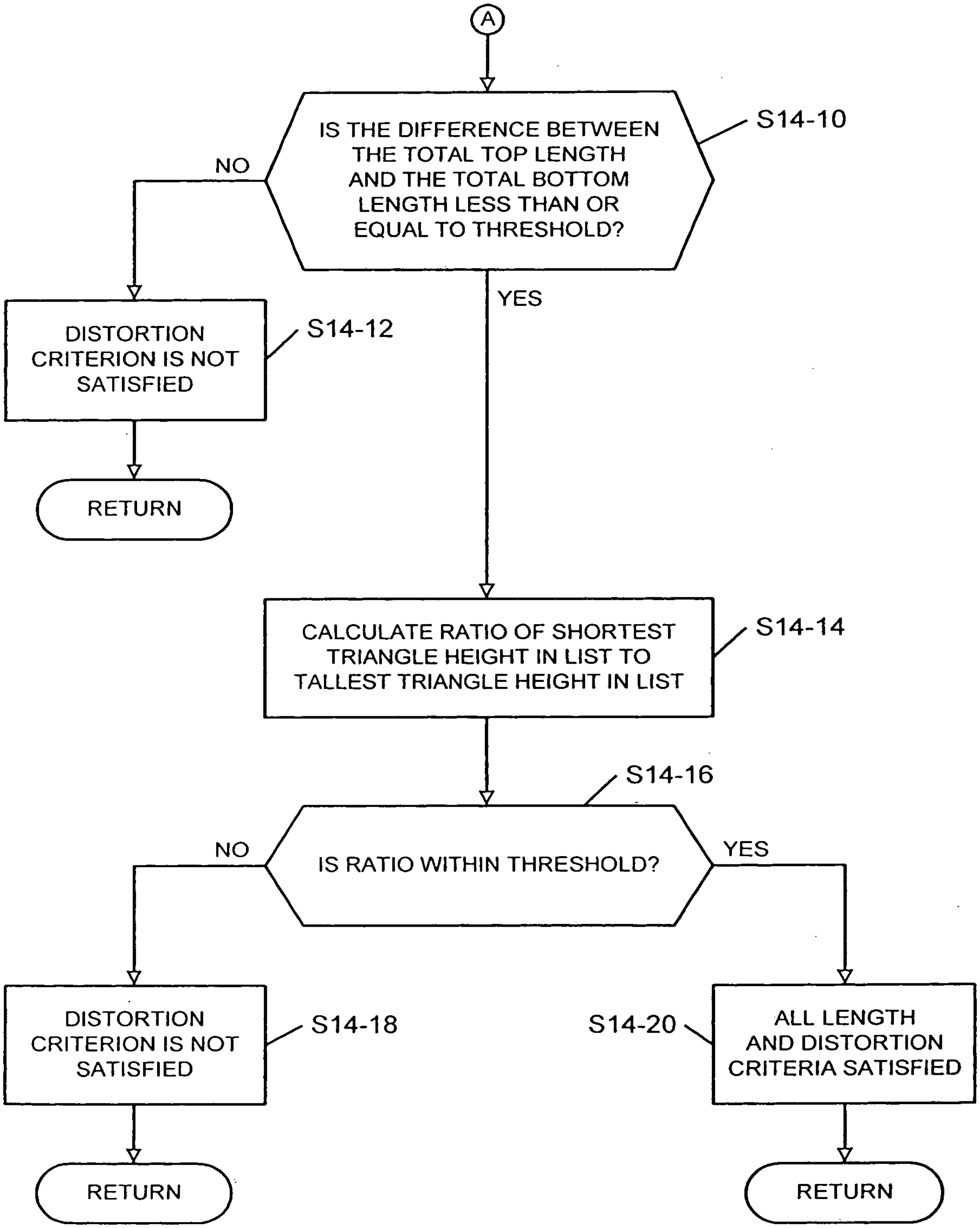
A
IS THE DIFFERENCE BETWEEN THE TOTAL TOP LENGTH AND THE TOTAL BOTTOM LENGTH LESS THAN OR EQUAL TO THRESHOLD?
S14-10
NO
YES
DISTORTION CRITERION IS NOT SATISFIED
S14-12
RETURN
CALCULATE RATIO OF SHORTEST TRIANGLE HEIGHT IN LIST TO TALLEST TRIANGLE HEIGHT IN LIST
S14-14
S14-16
NO
IS RATIO WITHIN THRESHOLD?
YES
DISTORTION CRITERION IS NOT SATISFIED
S14-18
S14-20
ALL LENGTH AND DISTORTION CRITERIA SATISFIED
RETURN
RETURN

Fig.15.

220

TRIANGLE : ID
TRIANGLE AREA : A
EDGE LENGTHS : L1; L2; L3
FRONT EDGE : EDGE NUMBER
BACK EDGE : EDGE NUMBER

230

TRIANGLE : ID
TRIANGLE AREA : A
EDGE LENGTHS : L1; L2; L3
FRONT EDGE : EDGE NUMBER
BACK EDGE : EDGE NUMBER

⋮

240

TRIANGLE : ID
TRIANGLE AREA : A
EDGE LENGTHS : L1; L2; L3
FRONT EDGE : EDGE NUMBER
BACK EDGE : EDGE NUMBER

Fig.16.

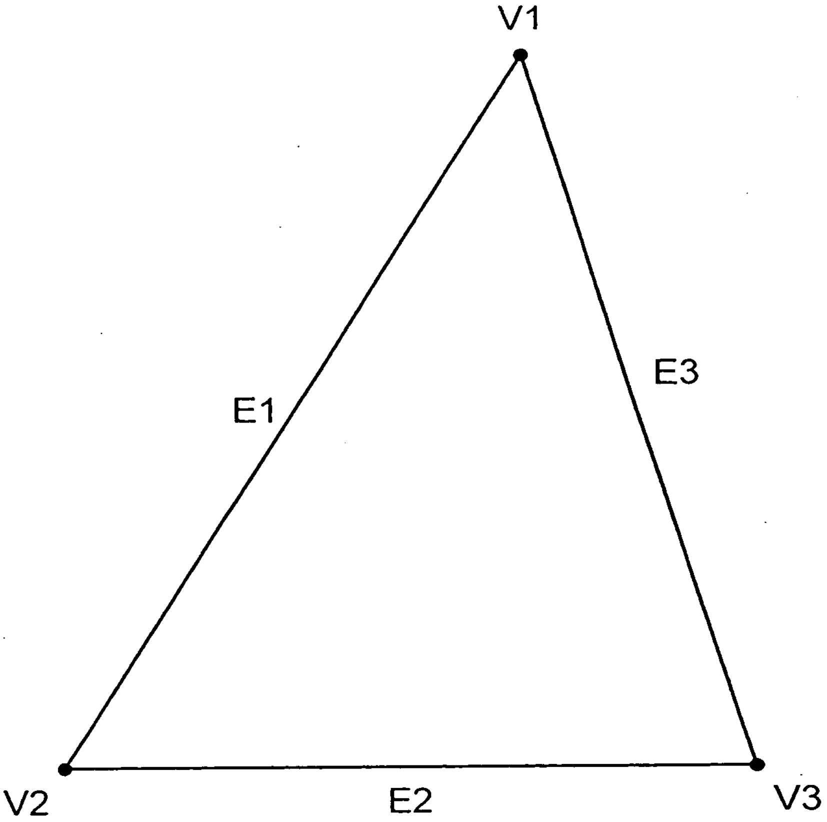

Fig.17a.

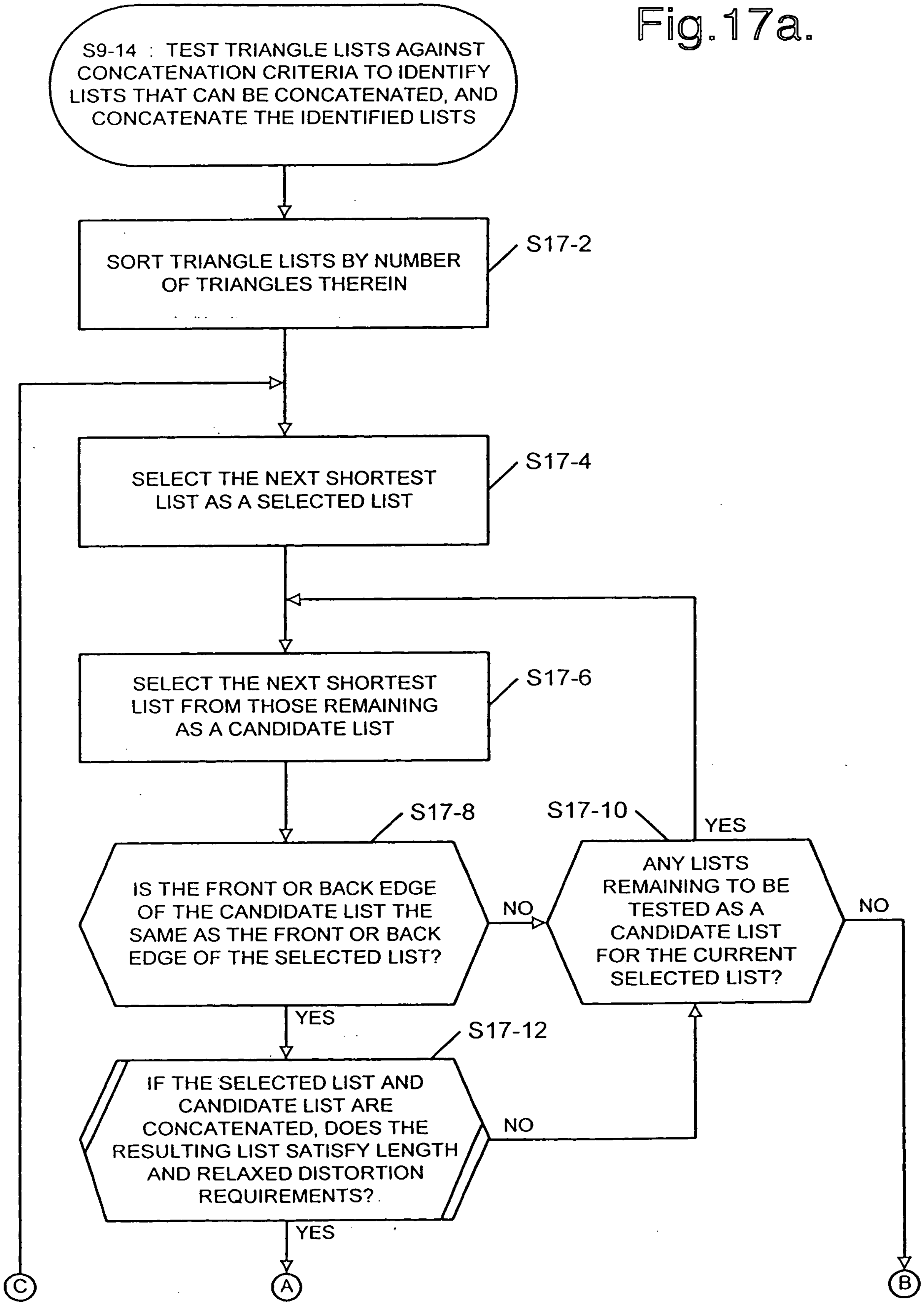
S9-14 : TEST TRIANGLE LISTS AGAINST CONCATENATION CRITERIA TO IDENTIFY LISTS THAT CAN BE CONCATENATED, AND CONCATENATE THE IDENTIFIED LISTS
SORT TRIANGLE LISTS BY NUMBER OF TRIANGLES THEREIN
S17-2
SELECT THE NEXT SHORTEST LIST AS A SELECTED LIST
S17-4
SELECT THE NEXT SHORTEST LIST FROM THOSE REMAINING AS A CANDIDATE LIST
S17-6
S17-8
IS THE FRONT OR BACK EDGE OF THE CANDIDATE LIST THE SAME AS THE FRONT OR BACK EDGE OF THE SELECTED LIST?
NO
S17-10
YES
ANY LISTS REMAINING TO BE TESTED AS A CANDIDATE LIST FOR THE CURRENT SELECTED LIST?
NO
YES
S17-12
IF THE SELECTED LIST AND CANDIDATE LIST ARE CONCATENATED, DOES THE RESULTING LIST SATISFY LENGTH AND RELAXED DISTORTION REQUIREMENTS?
NO
YES
C
A
B

Fig.17b.

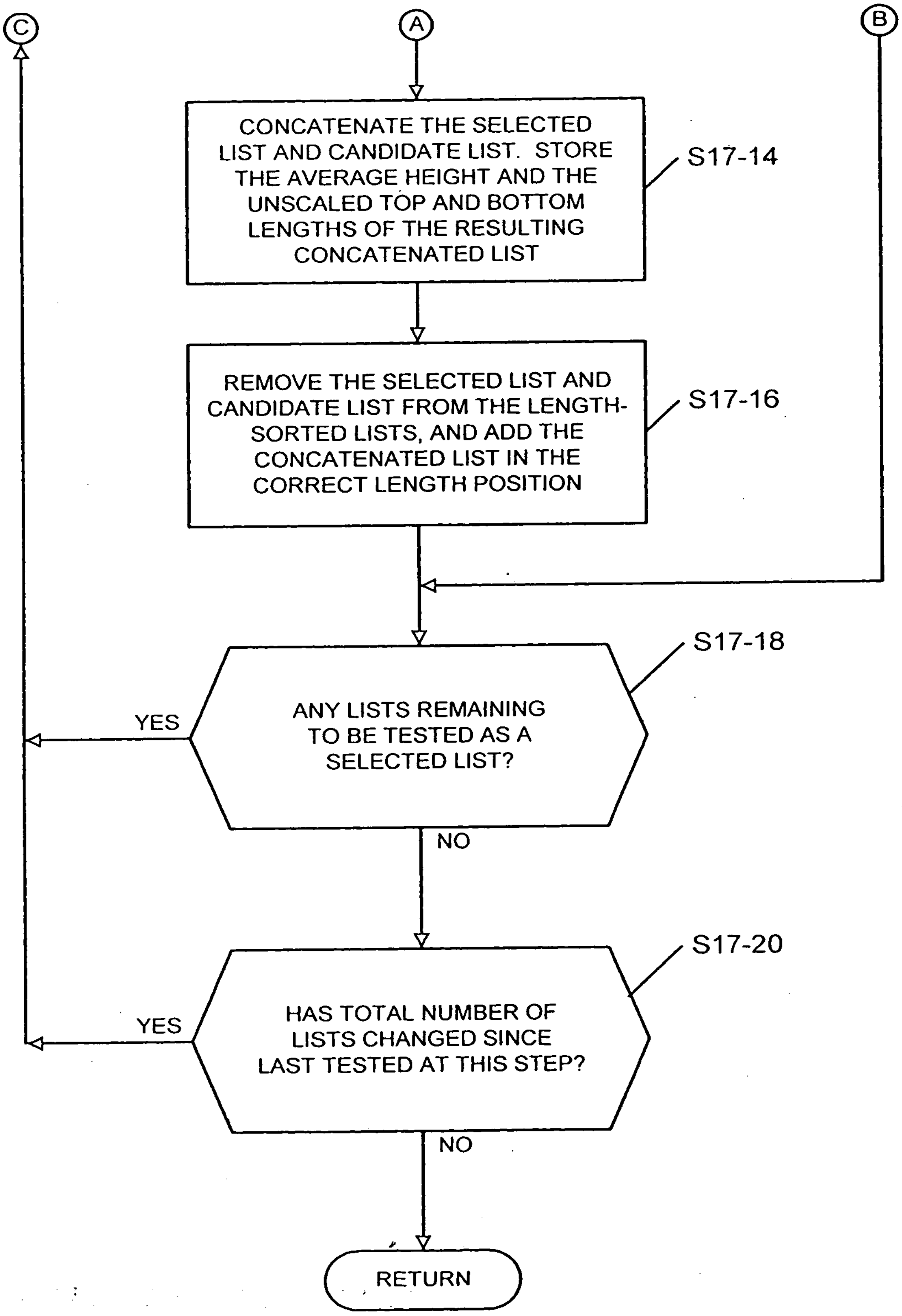
C
A
B
CONCATENATE THE SELECTED LIST AND CANDIDATE LIST. STORE THE AVERAGE HEIGHT AND THE UNSCALED TOP AND BOTTOM LENGTHS OF THE RESULTING CONCATENATED LIST
S17-14
REMOVE THE SELECTED LIST AND CANDIDATE LIST FROM THE LENGTH-SORTED LISTS, AND ADD THE CONCATENATED LIST IN THE CORRECT LENGTH POSITION
S17-16
S17-18
YES
ANY LISTS REMAINING TO BE TESTED AS A SELECTED LIST?
NO
S17-20
YES
HAS TOTAL NUMBER OF LISTS CHANGED SINCE LAST TESTED AT THIS STEP?
NO
RETURN

Fig. 18.

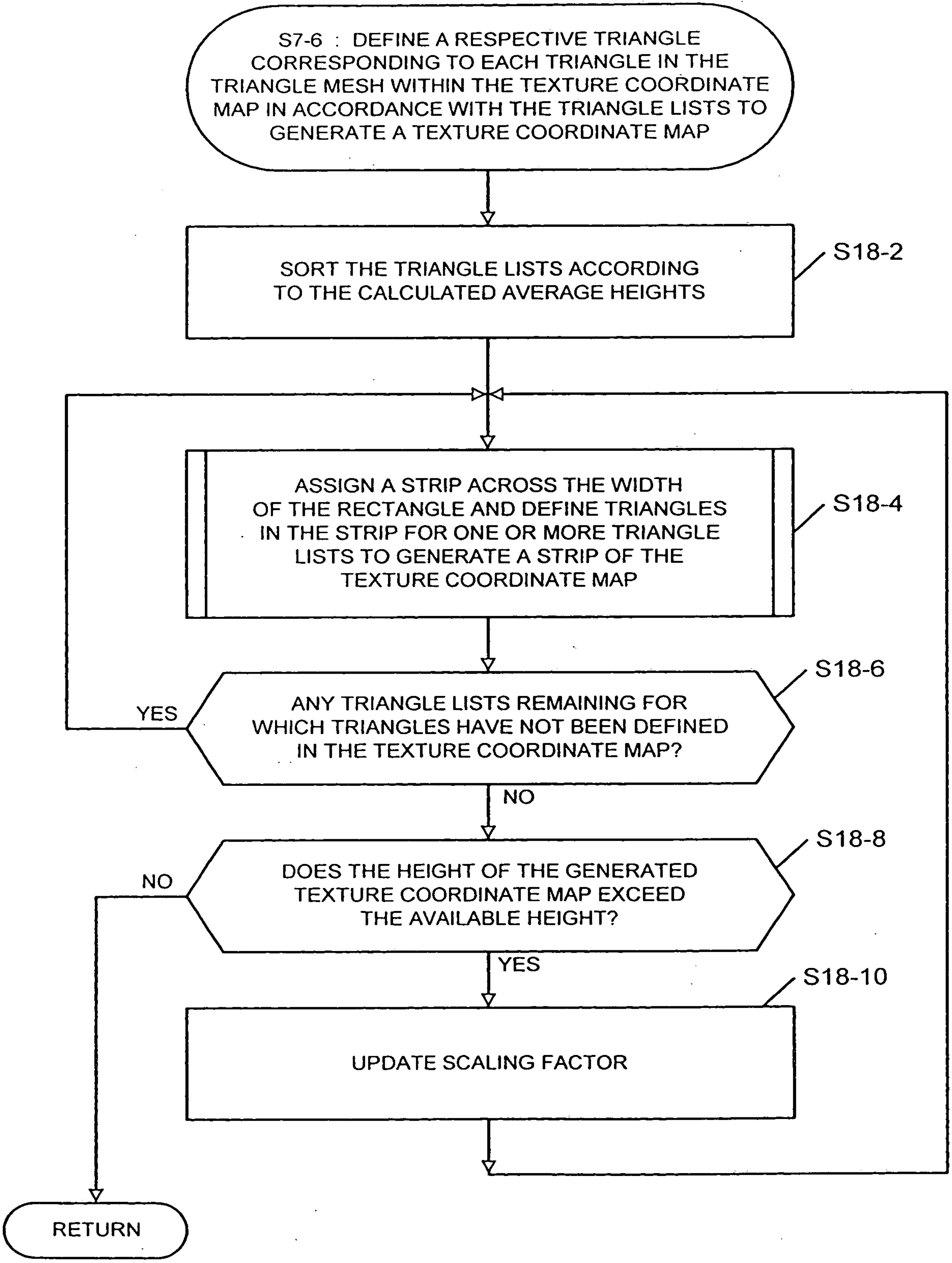
S7-6 : DEFINE A RESPECTIVE TRIANGLE CORRESPONDING TO EACH TRIANGLE IN THE TRIANGLE MESH WITHIN THE TEXTURE COORDINATE MAP IN ACCORDANCE WITH THE TRIANGLE LISTS TO GENERATE A TEXTURE COORDINATE MAP
SORT THE TRIANGLE LISTS ACCORDING TO THE CALCULATED AVERAGE HEIGHTS
S18-2
ASSIGN A STRIP ACROSS THE WIDTH OF THE RECTANGLE AND DEFINE TRIANGLES IN THE STRIP FOR ONE OR MORE TRIANGLE LISTS TO GENERATE A STRIP OF THE TEXTURE COORDINATE MAP
S18-4
ANY TRIANGLE LISTS REMAINING FOR WHICH TRIANGLES HAVE NOT BEEN DEFINED IN THE TEXTURE COORDINATE MAP?
S18-6
YES
NO
DOES THE HEIGHT OF THE GENERATED TEXTURE COORDINATE MAP EXCEED THE AVAILABLE HEIGHT?
S18-8
NO
YES
UPDATE SCALING FACTOR
S18-10
RETURN

Fig.19a.

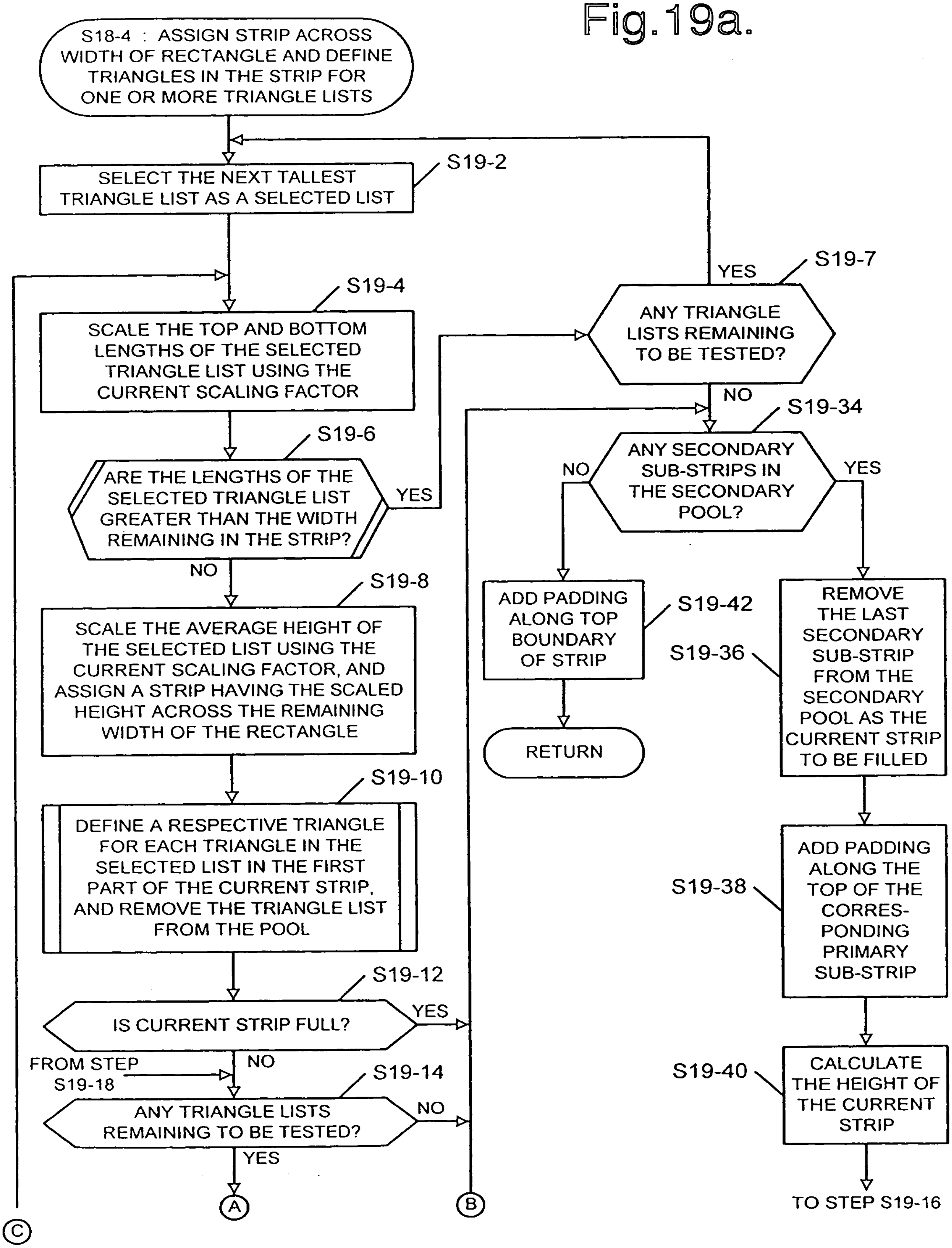
S18-4 : ASSIGN STRIP ACROSS WIDTH OF RECTANGLE AND DEFINE TRIANGLES IN THE STRIP FOR ONE OR MORE TRIANGLE LISTS
SELECT THE NEXT TALLEST TRIANGLE LIST AS A SELECTED LIST
S19-2
S19-4
SCALE THE TOP AND BOTTOM LENGTHS OF THE SELECTED TRIANGLE LIST USING THE CURRENT SCALING FACTOR
S19-6
ARE THE LENGTHS OF THE SELECTED TRIANGLE LIST GREATER THAN THE WIDTH REMAINING IN THE STRIP?
YES
NO
S19-8
SCALE THE AVERAGE HEIGHT OF THE SELECTED LIST USING THE CURRENT SCALING FACTOR, AND ASSIGN A STRIP HAVING THE SCALED HEIGHT ACROSS THE REMAINING WIDTH OF THE RECTANGLE
S19-10
DEFINE A RESPECTIVE TRIANGLE FOR EACH TRIANGLE IN THE SELECTED LIST IN THE FIRST PART OF THE CURRENT STRIP, AND REMOVE THE TRIANGLE LIST FROM THE POOL
S19-12
IS CURRENT STRIP FULL?
YES
NO
FROM STEP S19-18
S19-14
ANY TRIANGLE LISTS REMAINING TO BE TESTED?
NO
YES
A
B
C
S19-7
YES
ANY TRIANGLE LISTS REMAINING TO BE TESTED?
NO
S19-34
ANY SECONDARY SUB-STRIPS IN THE SECONDARY POOL?
NO
YES
ADD PADDING ALONG TOP BOUNDARY OF STRIP
S19-42
RETURN
REMOVE THE LAST SECONDARY SUB-STRIP FROM THE SECONDARY POOL AS THE CURRENT STRIP TO BE FILLED
S19-36
S19-38
ADD PADDING ALONG THE TOP OF THE CORRES-PONDING PRIMARY SUB-STRIP
S19-40
CALCULATE THE HEIGHT OF THE CURRENT STRIP
TO STEP S19-16

Fig.19b.

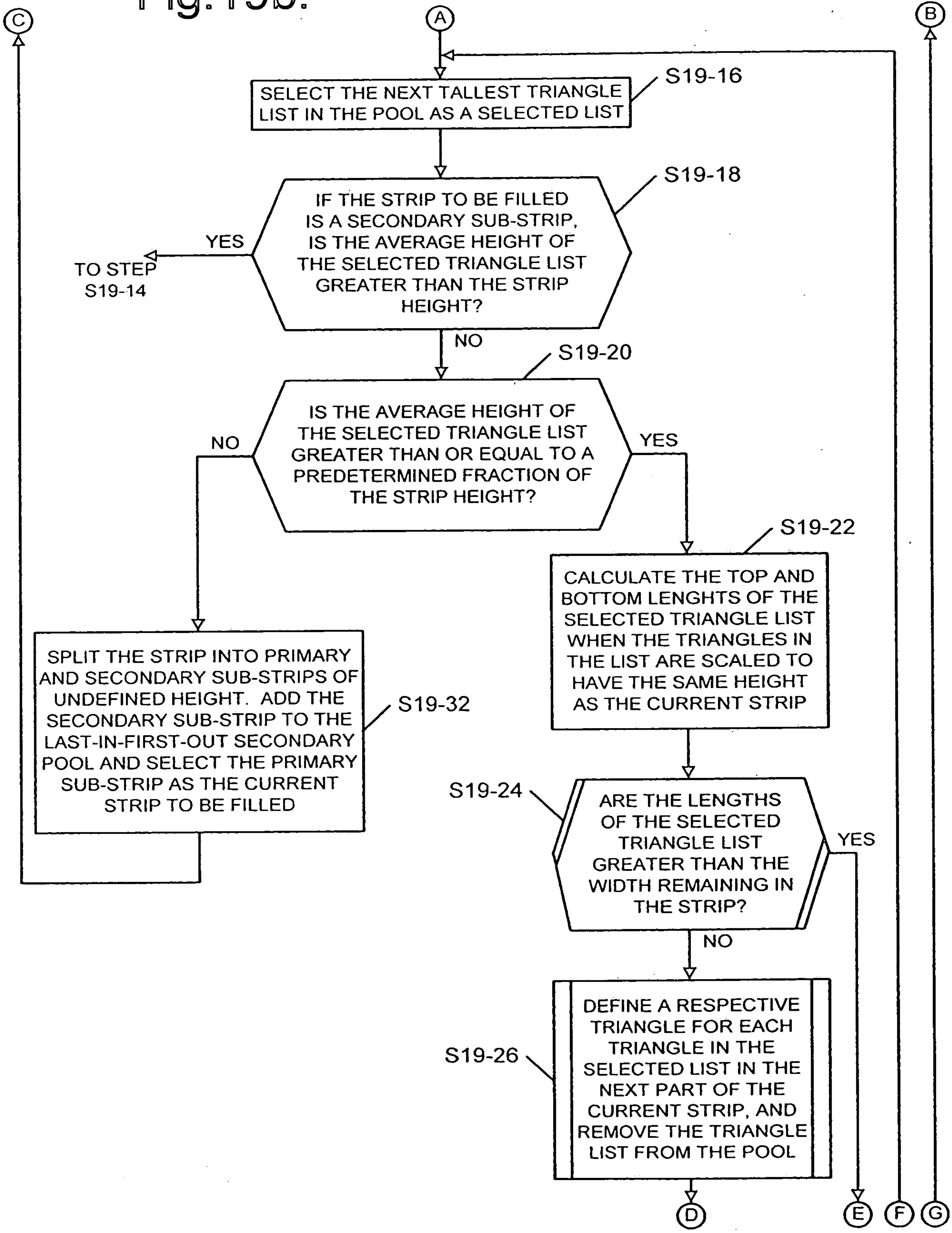
C
A
B
SELECT THE NEXT TALLEST TRIANGLE LIST IN THE POOL AS A SELECTED LIST
S19-16
IF THE STRIP TO BE FILLED IS A SECONDARY SUB-STRIP, IS THE AVERAGE HEIGHT OF THE SELECTED TRIANGLE LIST GREATER THAN THE STRIP HEIGHT?
S19-18
YES
TO STEP S19-14
NO
S19-20
IS THE AVERAGE HEIGHT OF THE SELECTED TRIANGLE LIST GREATER THAN OR EQUAL TO A PREDETERMINED FRACTION OF THE STRIP HEIGHT?
NO
YES
S19-22
CALCULATE THE TOP AND BOTTOM LENGHTS OF THE SELECTED TRIANGLE LIST WHEN THE TRIANGLES IN THE LIST ARE SCALED TO HAVE THE SAME HEIGHT AS THE CURRENT STRIP
SPLIT THE STRIP INTO PRIMARY AND SECONDARY SUB-STRIPS OF UNDEFINED HEIGHT. ADD THE SECONDARY SUB-STRIP TO THE LAST-IN-FIRST-OUT SECONDARY POOL AND SELECT THE PRIMARY SUB-STRIP AS THE CURRENT STRIP TO BE FILLED
S19-32
S19-24
ARE THE LENGTHS OF THE SELECTED TRIANGLE LIST GREATER THAN THE WIDTH REMAINING IN THE STRIP?
YES
NO
S19-26
DEFINE A RESPECTIVE TRIANGLE FOR EACH TRIANGLE IN THE SELECTED LIST IN THE NEXT PART OF THE CURRENT STRIP, AND REMOVE THE TRIANGLE LIST FROM THE POOL
D
E
F
G

Fig.19c.

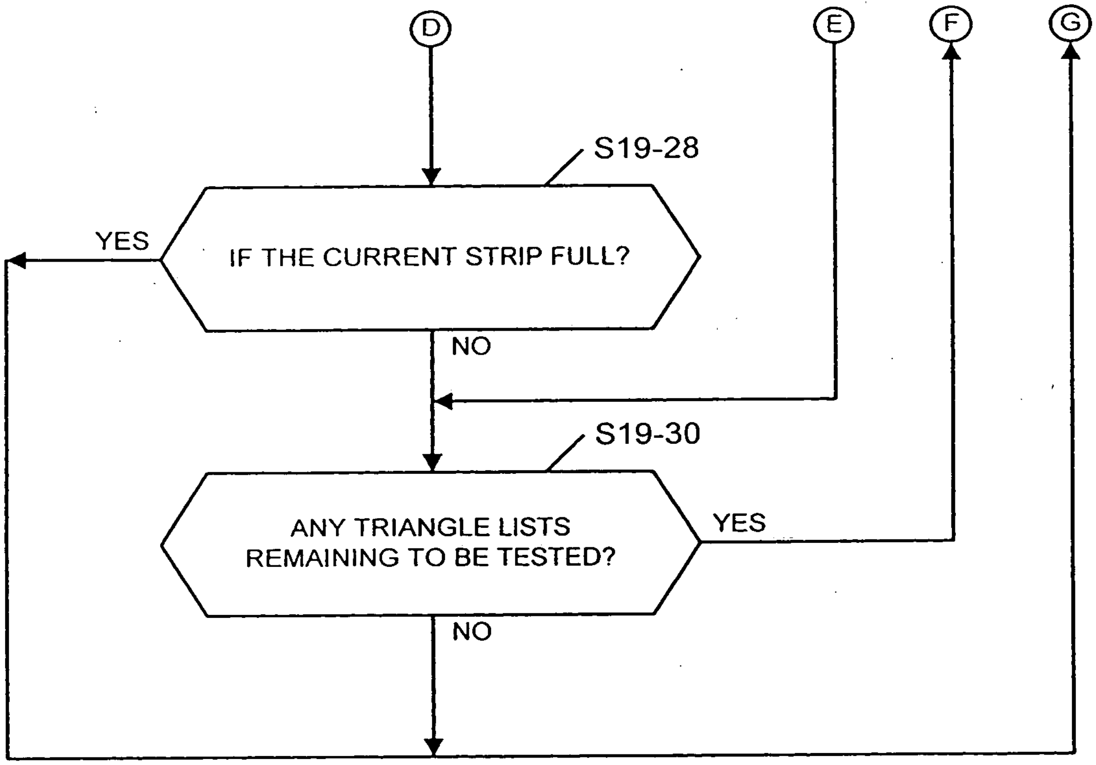
D
E
F
G
S19-28
IF THE CURRENT STRIP FULL?
YES
NO
S19-30
ANY TRIANGLE LISTS REMAINING TO BE TESTED?
YES
NO

Fig.20a.

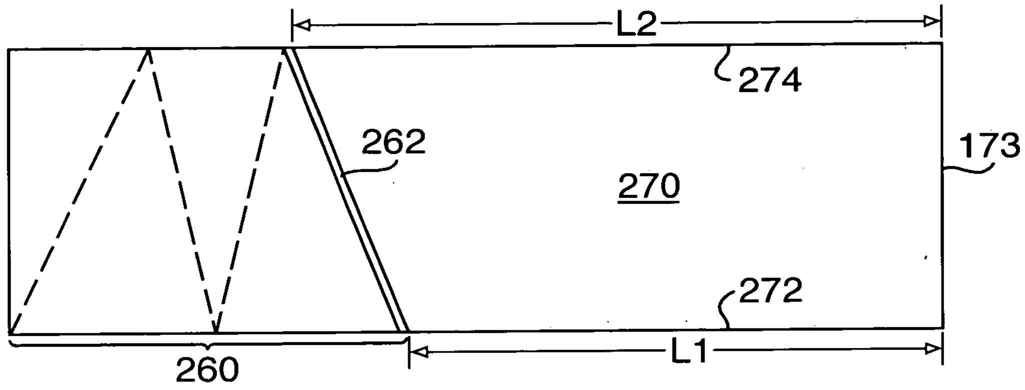

Fig.20b.

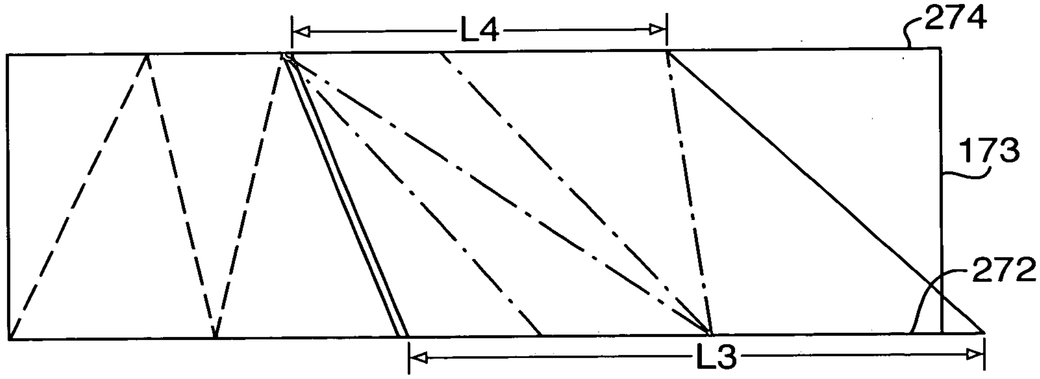

Fig.20c.

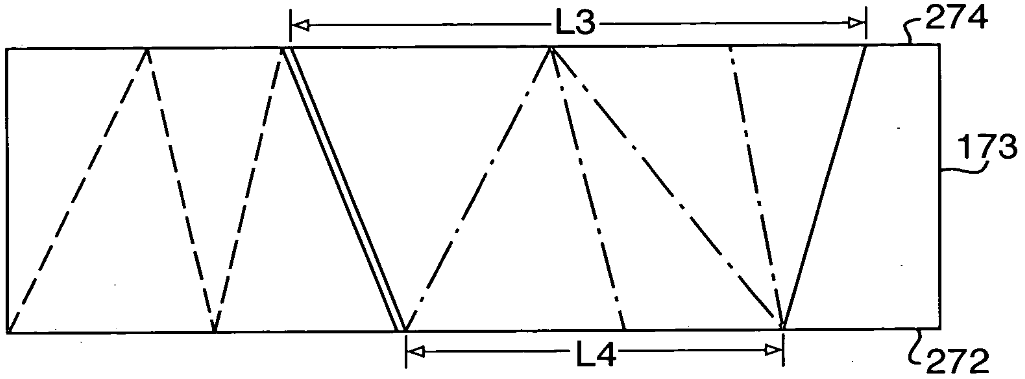

Fig.20d.

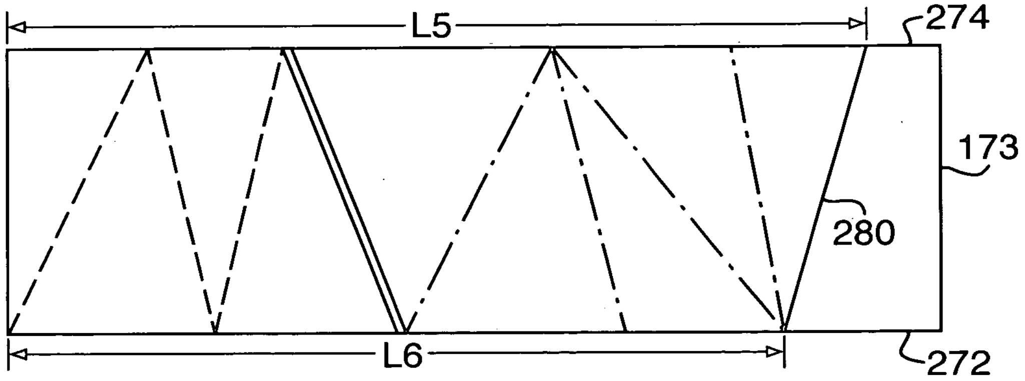

Fig.21a.

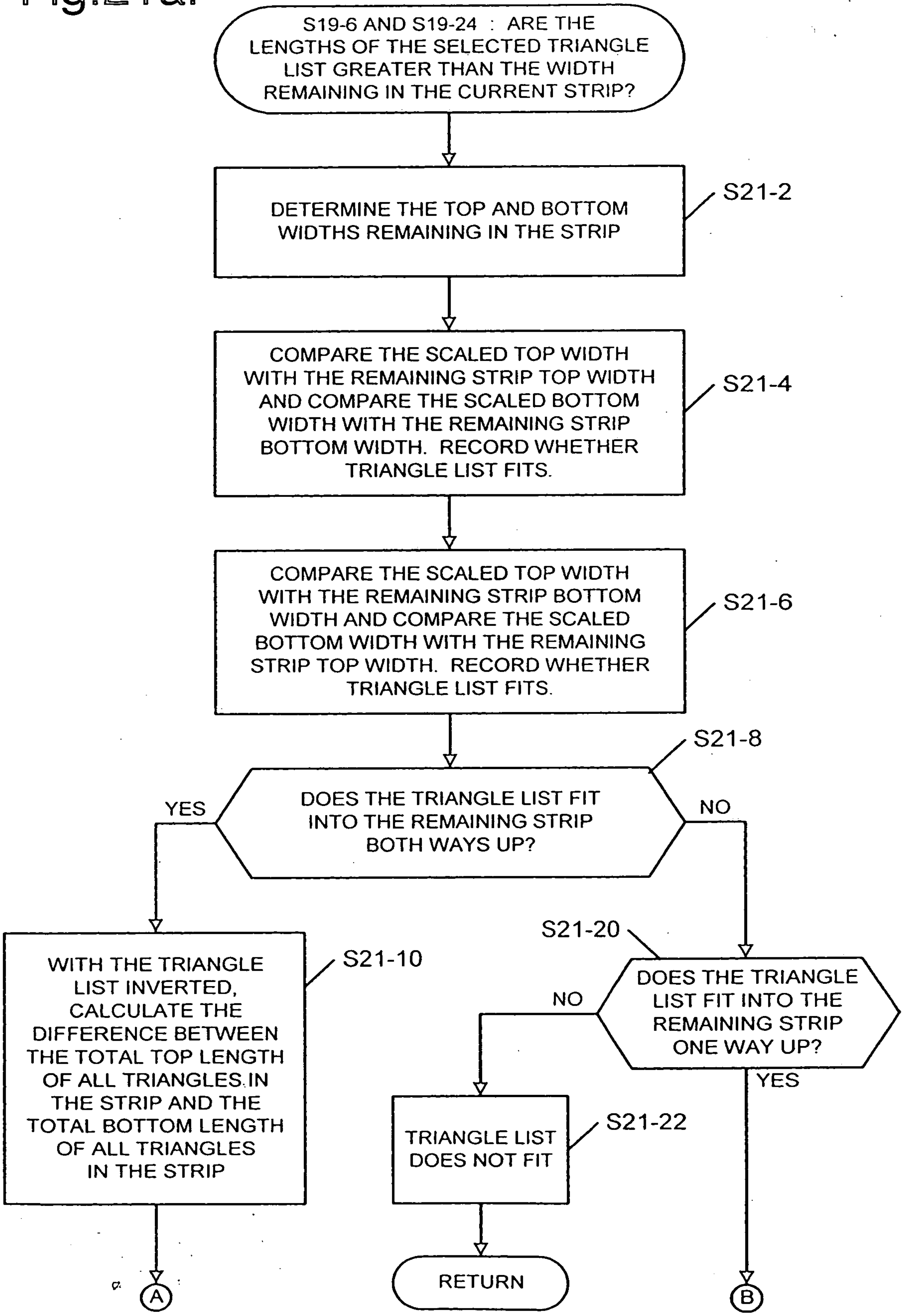
S19-6 AND S19-24 : ARE THE LENGTHS OF THE SELECTED TRIANGLE LIST GREATER THAN THE WIDTH REMAINING IN THE CURRENT STRIP?
DETERMINE THE TOP AND BOTTOM WIDTHS REMAINING IN THE STRIP
S21-2
COMPARE THE SCALED TOP WIDTH WITH THE REMAINING STRIP TOP WIDTH AND COMPARE THE SCALED BOTTOM WIDTH WITH THE REMAINING STRIP BOTTOM WIDTH. RECORD WHETHER TRIANGLE LIST FITS.
S21-4
COMPARE THE SCALED TOP WIDTH WITH THE REMAINING STRIP BOTTOM WIDTH AND COMPARE THE SCALED BOTTOM WIDTH WITH THE REMAINING STRIP TOP WIDTH. RECORD WHETHER TRIANGLE LIST FITS.
S21-6
S21-8
DOES THE TRIANGLE LIST FIT INTO THE REMAINING STRIP BOTH WAYS UP?
YES
NO
WITH THE TRIANGLE LIST INVERTED, CALCULATE THE DIFFERENCE BETWEEN THE TOTAL TOP LENGTH OF ALL TRIANGLES IN THE STRIP AND THE TOTAL BOTTOM LENGTH OF ALL TRIANGLES IN THE STRIP
S21-10
S21-20
DOES THE TRIANGLE LIST FIT INTO THE REMAINING STRIP ONE WAY UP?
NO
YES
TRIANGLE LIST DOES NOT FIT
S21-22
RETURN
A
B

Fig.21b.

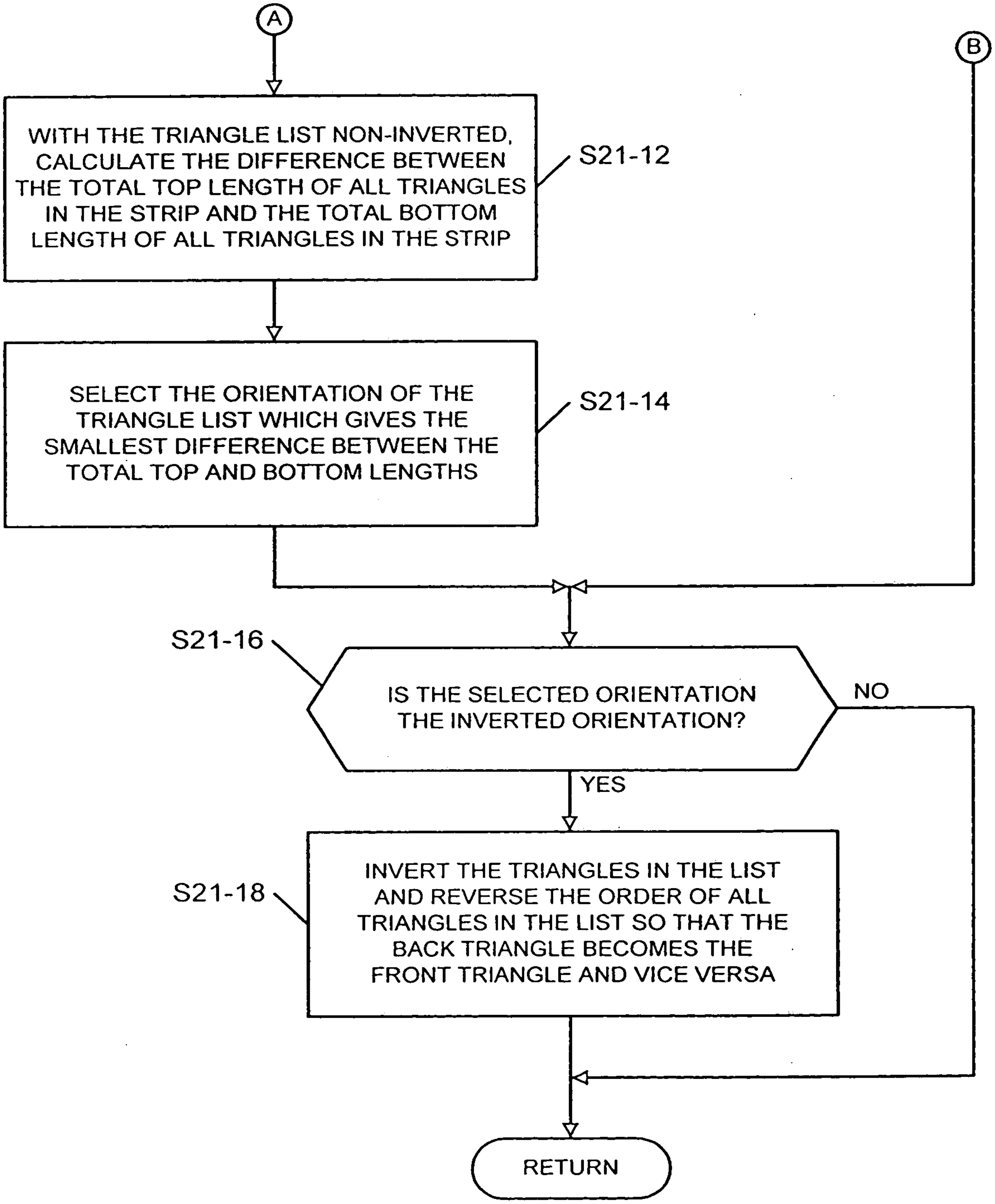
A
B
WITH THE TRIANGLE LIST NON-INVERTED, CALCULATE THE DIFFERENCE BETWEEN THE TOTAL TOP LENGTH OF ALL TRIANGLES IN THE STRIP AND THE TOTAL BOTTOM LENGTH OF ALL TRIANGLES IN THE STRIP
S21-12
SELECT THE ORIENTATION OF THE TRIANGLE LIST WHICH GIVES THE SMALLEST DIFFERENCE BETWEEN THE TOTAL TOP AND BOTTOM LENGTHS
S21-14
S21-16
IS THE SELECTED ORIENTATION THE INVERTED ORIENTATION?
NO
YES
S21-18
INVERT THE TRIANGLES IN THE LIST AND REVERSE THE ORDER OF ALL TRIANGLES IN THE LIST SO THAT THE BACK TRIANGLE BECOMES THE FRONT TRIANGLE AND VICE VERSA
RETURN

Fig.22.

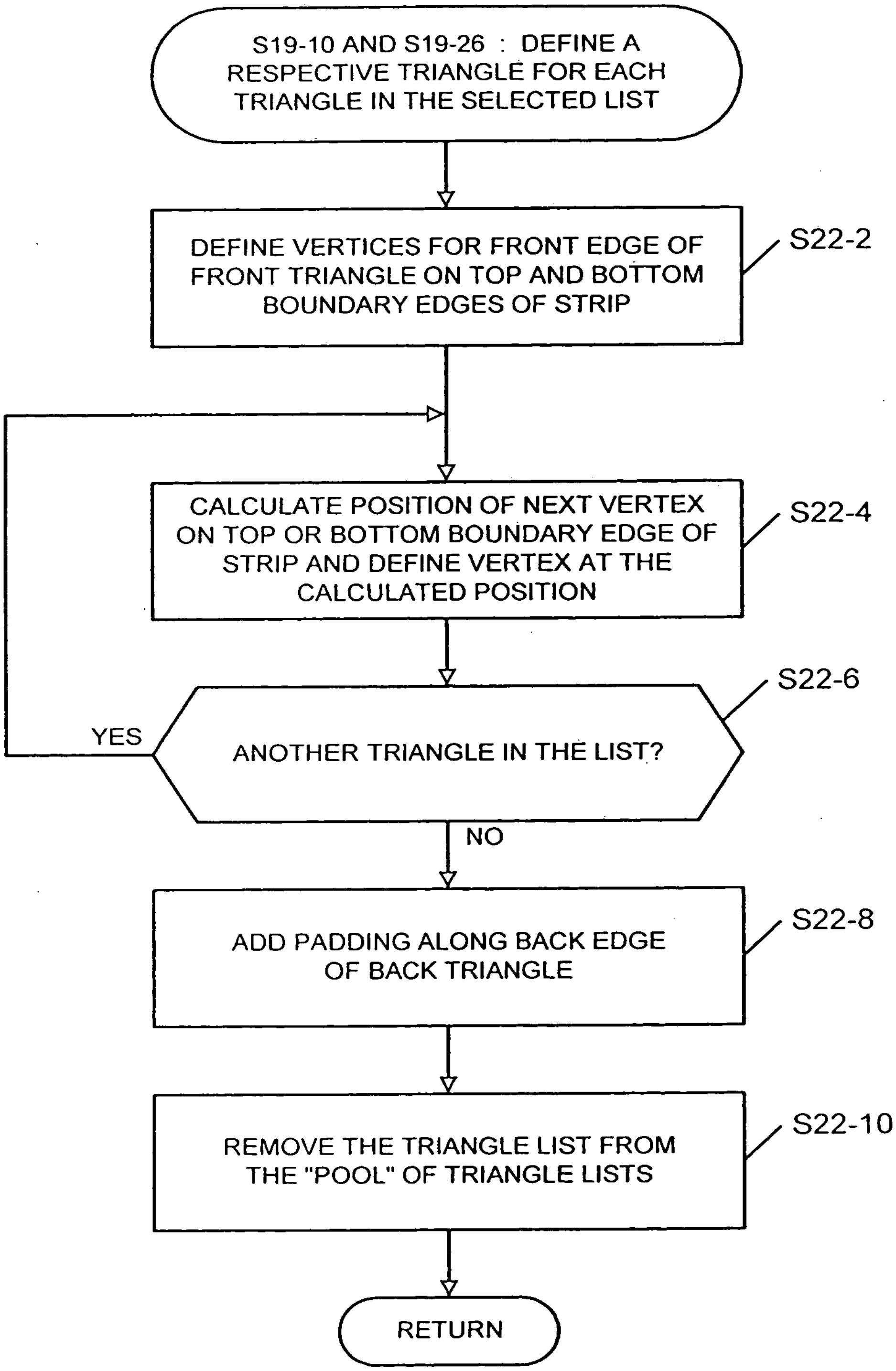
S19-10 AND S19-26 : DEFINE A RESPECTIVE TRIANGLE FOR EACH TRIANGLE IN THE SELECTED LIST
DEFINE VERTICES FOR FRONT EDGE OF FRONT TRIANGLE ON TOP AND BOTTOM BOUNDARY EDGES OF STRIP
S22-2
CALCULATE POSITION OF NEXT VERTEX ON TOP OR BOTTOM BOUNDARY EDGE OF STRIP AND DEFINE VERTEX AT THE CALCULATED POSITION
S22-4
ANOTHER TRIANGLE IN THE LIST?
S22-6
YES
NO
ADD PADDING ALONG BACK EDGE OF BACK TRIANGLE
S22-8
REMOVE THE TRIANGLE LIST FROM THE "POOL" OF TRIANGLE LISTS
S22-10
RETURN

Fig.23a.

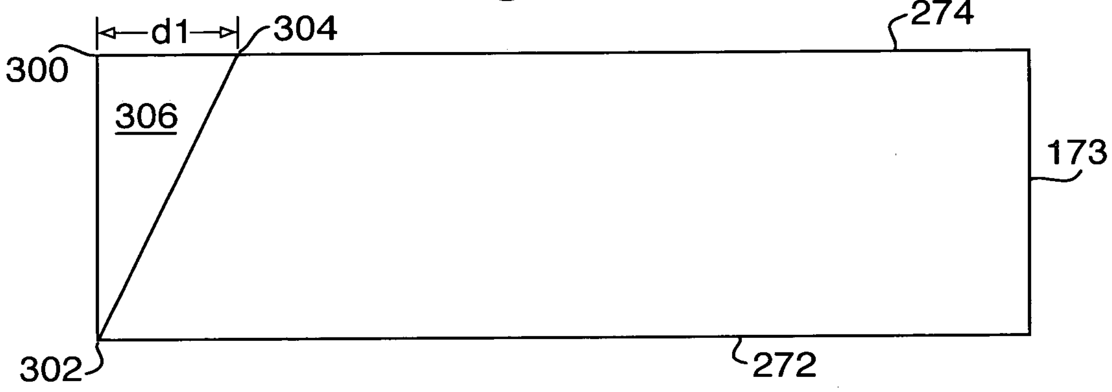

Fig.23b.

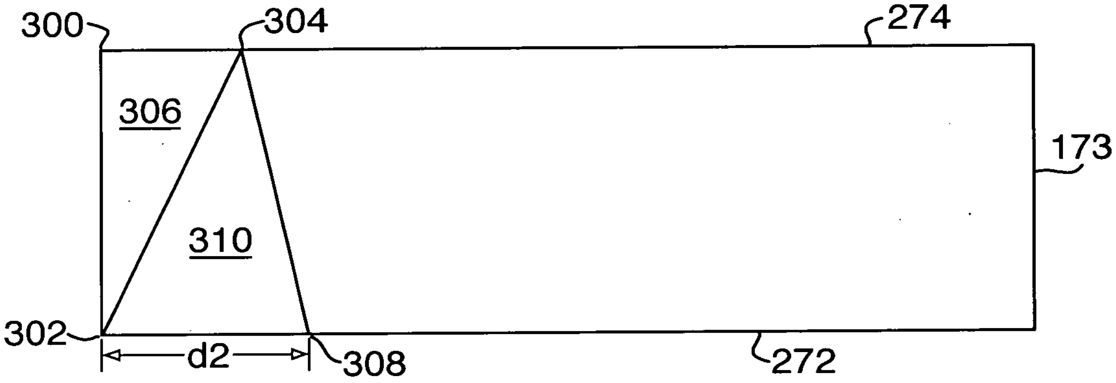

Fig.23c.

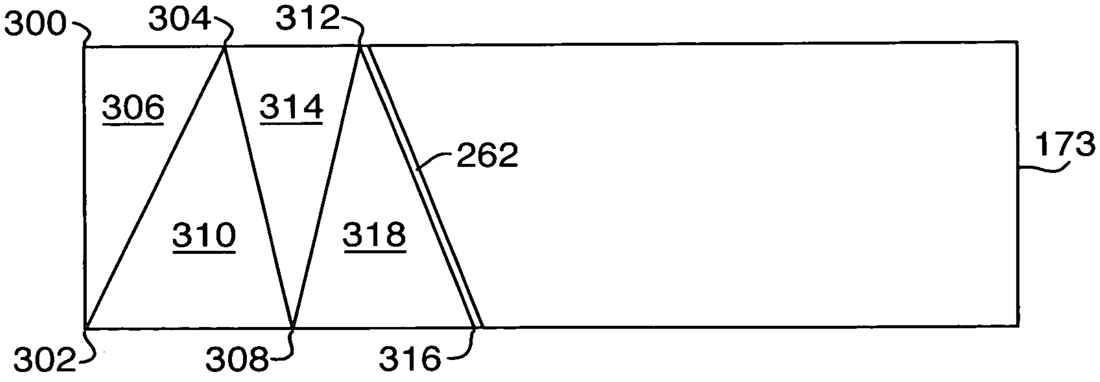

Fig.23d.

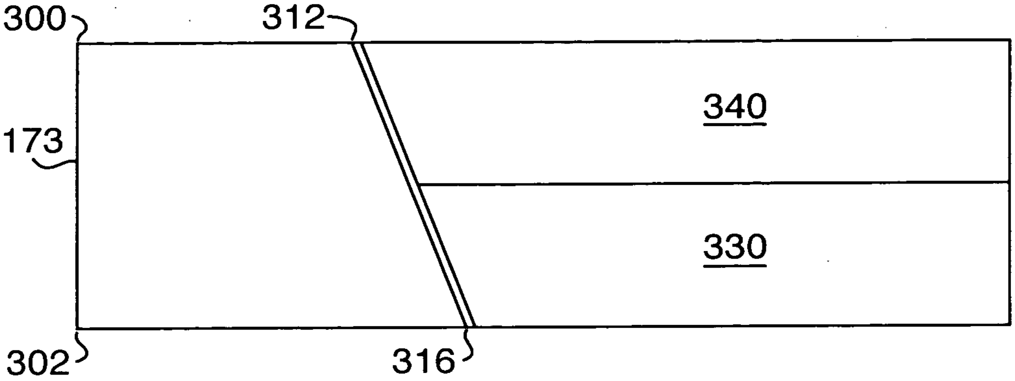

Fig.23e.

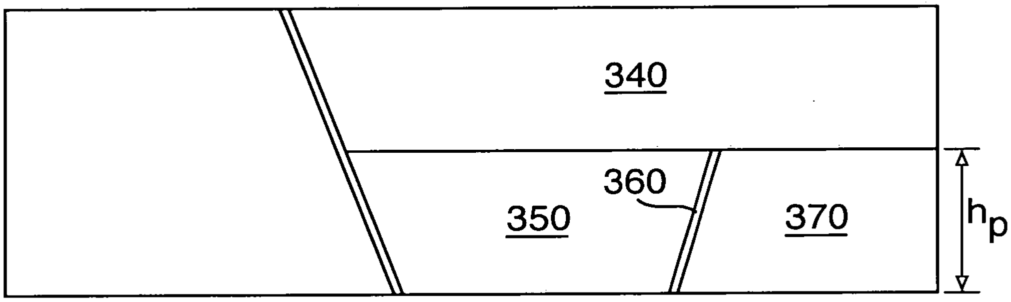

Fig.23f.

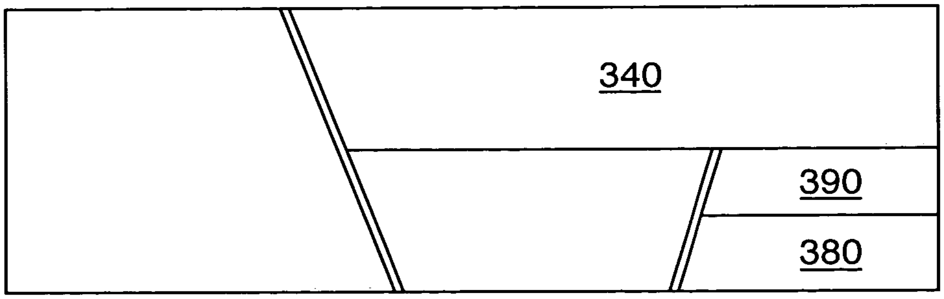

Fig.23g.

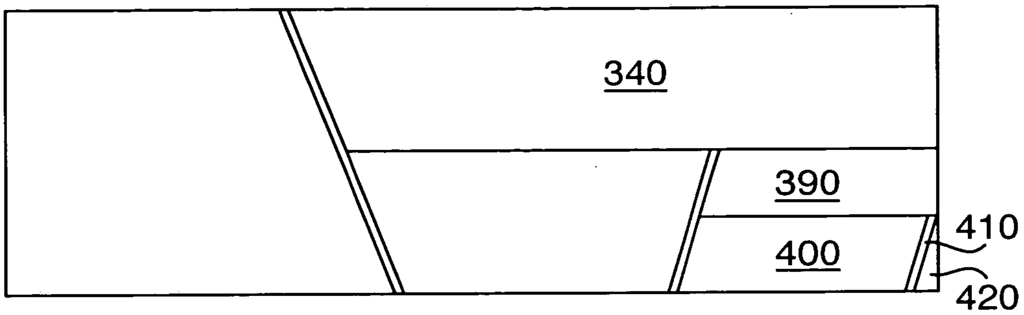

Fig.23h.

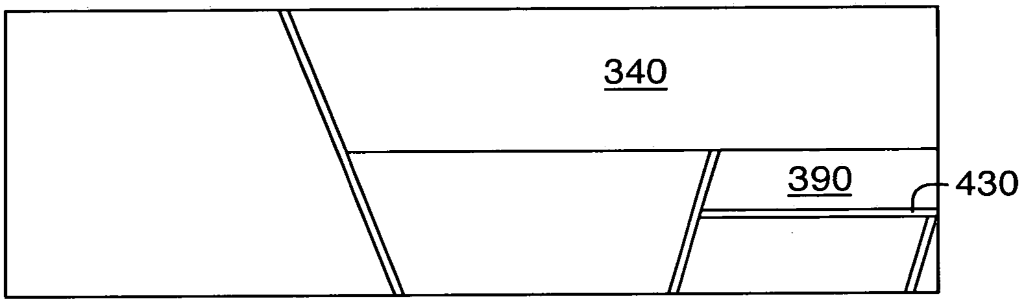

Fig.23i.

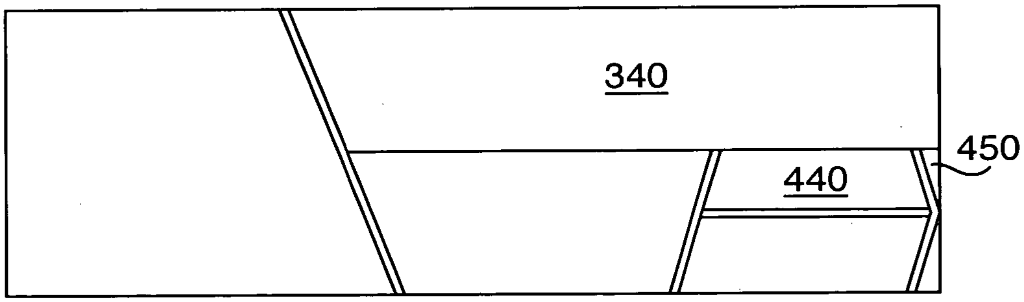

Fig.23j.

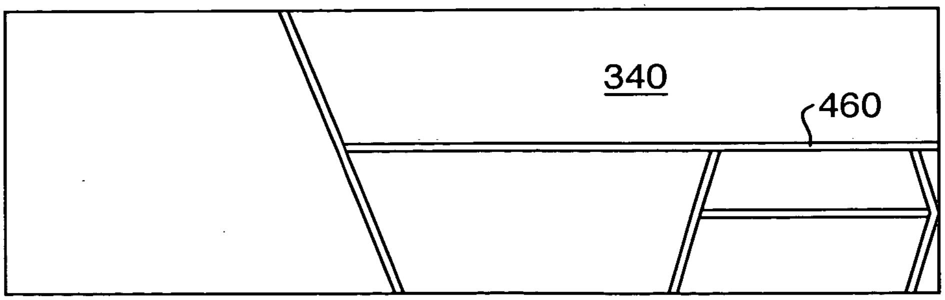

Fig.24.